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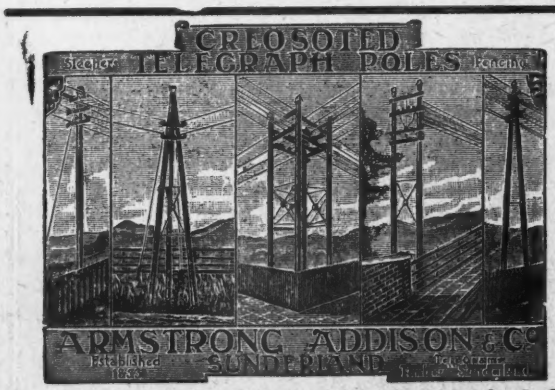

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THE
ELECTRICAL REVIEW.

VOL. LXXVIII. JUNE 9, 1916. No. 2,011.

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LINKING-UP.

THE announcement made in our last issue, too late for editorial comment, that the engineers of Lancashire and Cheshire were actively developing a scheme for the purpose of interconnecting the principal supply stations of those counties, formed a most appropriate and well-timed supplement to the circular issued by the Board of Trade in the previous week. It showed that those engineers were fully alive to the possibilities and importance of the proposal, which indeed was not entirely new, but was brought within the scope of practical politics by the war, and they had anticipated the action of the Board of Trade by several weeks; already they had divided up the area into districts and appointed sub-Committees to investigate the conditions obtaining in each district, and no doubt we shall shortly be in a position to report further progress. The immediate credit for the local movement is due to Mr. J. A. Robertson, of Salford, who, in opening the discussion on Mr. E. T. Williams's paper, outlined the policy which is now being pursued; but the greater includes the less, and it must be acknowledged that the idea of interconnecting existing stations formed one of the fundamental and essential features of the more elaborate scheme described by Mr. Williams, to whom, therefore, the thanks of the industry are especially due. It is obvious that if each of the districts in which the conditions favour interconnection independently proceeds to carry out the policy, we shall eventually have a small number of organised areas in which the principle of mutual assistance and support is recognised and adopted, and then there should be far less difficulty in advancing further towards the national organisation so powerfully advocated by Mr. Williams—in fact, it amounts to commencing at the bottom and working upwards, instead of the reverse; and that is the best way to erect a substantial and enduring edifice.

A suggestion has been put forward by Mr. Williams that the Council of the Institution of Electrical Engineers, in view of the trend of opinion disclosed by the discussions, should take energetic action towards the development of the scheme, and we cordially endorse this view. Whether the matter be held by some to be of a "political" nature, or by others to involve "grave difficulties," we care not a jot; we are at war. This is no time for mincing words or splitting hairs; there is general agreement amongst the members of the Institution that the co-ordination of our electricity supply undertakings ought to be carried out; the Board of Trade is anxious to see it done; the engineers themselves—at any rate, in one area—are pushing on with it; and the Council, which is armed under the Memorandum of Association with the widest possible powers to take any lawful action in respect of legislative or industrial matters which may conduce to the advancement of the applications of electrical science, in 1914 pledged itself to take such action. Here is an excellent opportunity for the Institution to take the lead, which, at the outbreak of the war, was passing to other hands. There may never be such another opportunity for it to regain the prestige which it has lost, and to demonstrate its ability and determination to act with promptitude and energy.

We do not suggest that the Lancashire and Cheshire movement is in need of assistance; we are thinking rather of the districts in which no action has yet been taken, but which offer similar possibilities, and only await the initiative. The Council might well communicate with the Board of Trade, and undertake to organise conferences in those areas, with a view to carrying out the Board's proposal.

Support Home Industries.

Most of us are agreed that in the future we should give British engineering manufactures a very decided preference when the expenditure of British public money is involved. Whatever the national policy may be, the municipalities will have to be prepared to reckon with the anti-enemy feeling of the community for a time. But what about that vast number of semi-public undertakings owned by companies and by private parties whose transactions need never be divulged to the public gaze? Can these—railways, collieries, mills, factories, &c.—be relied upon to patriotically support home industries if the Teuton, with his wily way, extends the tempting bait? If we were to judge from what occurred in pre-war days we might despair of reformation in connection with the policy of some of these concerns. Consider the case of British collieries—what a tale could be unfolded regarding the installation of German plant! What chances the British electrical manufacturer has been deprived of by the readiness of owner and adviser to buy elsewhere! But *autres temps, autres moeurs*, and we will indulge the hope that directors and shareholders, owners and advisers, will see that, as we have pointed out in another case, German cheapness may be purchased at too high a price. Pending the declaration of anything definite in regard to a national policy in this connection, we must have faith in the loyalty and determination, and the educational influence, that individual engineers and organisations can exercise. But among the signs of the times which are very welcome is the example of the Oxcroft Colliery Co., Ltd., which is giving out its contracts upon the distinct understanding that the company, firm, or individual to whom they are sent is not in any way under the influence or control directly or indirectly of any German, whether naturalised or otherwise, and that none of the payments or profits arising from the execution of the contracts will pass into the hands of Germans as shareholders, partners, or otherwise. In all probability as time passes we shall hear of all kinds of efforts which private concerns are prepared to make in order to secure the benefit of their contracts to British firms and British investors. The Oxcroft decision will be difficult to apply, for it will not permit even a small proportion of the capital to be held by any naturalised or unnaturalised German, nor may the business be even indirectly influenced or controlled by anybody of German taint. The Oxcroft spirit is willing and most commendable, but perhaps it will be found that the flesh is weak. Such a sweeping decision must, however, make the blood of the purely British electrical and engineering firms flow fast in their veins!

Lead.

The chief feature in the market for pig lead in recent weeks has been the fact that the authorities came to the rescue of consumers by placing at their disposal in the open market large quantities of metal that was held under their control out of the supplies that came from Australia and Spain. Consumers who had run rather short of stock thus availed themselves pretty freely of this opportunity of replenishing in a constantly falling market, under well sustained offerings from that quarter. Some thousands of tons were thus taken care of for prompt delivery. Prices fell to about £31 7s. 6d. a ton, but there has been since some recovery with a very irregular tendency, while offers of Government lead have come to a standstill.

The action of the Government came rather as a surprise to consumers and dealers, who undoubtedly under-rated the importance of this factor. Apparently the authorities were not immediately in need of the metal disposed of, but the fact remains that considerable quantities continue to be absorbed for war munitions, so that it is rather doubtful whether experience will repeat itself in that respect. However, it is generally assumed that developments are for the time being in no small degree subject to the policy pursued by the authorities, who, moreover, seem resolute in keeping down prices. Indications are now towards a further recovery, although no important developments are looked for, this view being based on the assumption that consumers have been recently pretty well filled up, while export trading has remained almost a negligible quantity, as licences are difficult to obtain. The withholding of permits for months past is largely accounted for by the fact that allied countries have been enabled in the last few months to fill their requirements direct from producing centres, such as Spain and Australia. The importance of the London market, therefore, as an international centre is nothing like what it used to be.

The receipts from Spain have this year fallen off, and they are likely to continue comparatively light. During the first quarter of this year, France imported no less than 21,500 tons, or about 14,000 tons more than in the previous year, the great bulk of which came from Spain. It is difficult to form any idea of the true merits of the position, while there are no reliable particulars having regard to the progress of production, yet it is probable that in view of the abnormally high prices, operations in most mining districts, except Spain and Mexico, have been well maintained. The price is now in the neighbourhood of £32 for near delivery, with forward metal at a discount of about 12s. 6d. a ton. Whereas the two extreme points recorded in the past year were £18 6s. 3d. and £30 5s., the price this year rose as high as £36 10s., in spite of the new regulation. There is certainly plenty of lead to go round without resort to importations from America, where prices still stand at a very high level.

The Wire-Drawing Industries.

As the war continues the position in the wire-drawing industries, particularly in the copper section, in common with most other controlled trades, appears to be experiencing increasing difficulties as regards supplies of raw materials. While wire manufacturers do not by any means expect their trade to be immune from the difficulties under which other industries are labouring at the present time, there appears to be some just cause for complaint at the somewhat loose manner in which the Government is handling the freight problem in regard to the supplies of raw metals, particularly copper.

Whereas, on the one hand, the demands from the Government upon wire manufacturers for goods are practically unlimited, and tend to increase as time goes on, the supplies of raw material, the delivery of which now depends entirely upon the authorisation and good organisation of the Government, become more lean and precarious every day. The department under the nominal control of the Ministry of Munitions, which was instituted for the purpose, among others, of ensuring manufacturers a necessary supply of copper, &c., when the freight difficulties otherwise threatened a stoppage of supplies from the normal source, has hardly come up to expectations, and, in most cases, where manufacturers have appealed to this department, they have obtained no satisfaction or sympathy.

The Government officials, apparently, do not sufficiently realise the gravity of the situation, which threatens a serious curtailment of output by wire manufacturers in the near future unless a more sympathetic attitude is manifested towards the vital needs of these trades. It is not improbable that the Minister of Munitions, personally, has not been made sufficiently to realise the gravity of the situation; in which event, an explanation from the High-Conductive Copper Association would, perhaps, prove of considerable weight towards instituting an improvement in the situation.

ELECTRIC VEHICLE PROGRESS.

This year's annual meeting of the (American) Electric Vehicle Section of the National Electric Light Association—our old friend the Electric Vehicle Association of America under a new guise—was held in Chicago during the fourth week in May, and judging by the shoal of papers and reports, for which we are indebted to the Association and to Mr. Jackson Marshall, secretary of the Section in question, it appears to have been as prolific as usual in these matters.

As mentioned previously in our pages, the Electric Vehicle Association recently affiliated with the N.E.L.A., and its annual proceedings now constitute a Section of the annual convention of the larger Association, which incidentally has increased its membership by 948 new members through the amalgamation.

Some of the Committee reports of the Section are of considerable interest to engineers on this side; one of them dealing with federal and municipal transportation, which recalls Mr. Ayton's paper before our own Electric Vehicle Committee last year, contains a comprehensive survey of this particular class of transport service, referring particularly to fire, ambulance, street cleaning and postal uses. As regards the last-named branch of vehicle work we cannot claim much progress in this country, but in municipal circles there appears to be evidence of a growing interest in the "electric," which promises well for the future. We notice in the report a view of the G.V. electric street-watering vehicle in use at Blackpool (which, by the way, our American friends refer to as "a suburb of London"!); 60 of these vehicles are stated to be in use in American and European cities. Judging by the somewhat dangerous economies in scavenging and street watering which many of our municipal authorities are stated to be practising at the present time, owing to shortage of horses and men, an opportunity has undoubtedly arisen for introducing modern labour-saving street appliances, amongst which the battery-driven vehicle, in view of the conditions, should take a leading position.

A brief reference occurs to battery-driven road-rollers. Somewhat similar motor-operated rollers are stated to have been used with great success in the Middle West, served with energy from central station lines by means of flexible cable.

On the subject of postal vehicles, it appears that the "electric" has been specified by the Chicago authorities, while both the Boston and New York Postal Departments have fleets of 2-ton and other vehicles in service; the battery exchange system is in use in both cities, and some of the New York trucks are kept in service practically day and night, only returning to the service station for two 15-min. periods each 24 hours to change the batteries and drivers.

Another report dealing with insurance shows that an effort is being made to obtain regular preferential treatment for electric vehicles, and that special reduced rates are being accorded by various companies. The difficulty appears to be that the vehicle user does not make a point of dealing with the companies offering preferential rates.

A joint report of Committees dealing with operating records, garages, and rates presents some graphic illustrations of data already established regarding the cost of operating electric vehicles, energy consumed for charging purposes, and garage space required for various sizes of vehicles, together with a chart showing an analysis of the cost of garaging commercial electric vehicles.

The cost data summarised in Curve No. 1 (page 641) are derived from the *Electrical World* investigation of groups of installations, published in May last.

Curve No. 2 (page 641) is based on the experience of a number of electric vehicle operators, and will, it is hoped, serve as a means of definitely establishing the question of rate-making for normal energy supply.

The detailed analysis of garaging costs will, no doubt, be useful for reference in this country, although the actual figures have only a comparative value. The total costs for garaging electric vehicles per month are given as follows:—Capacity, 700 lb., \$37·8; 1,000 lb., \$42·3; 2,000 lb., \$47·9; 4,000 lb., \$60·1; 7,000 lb., \$70·9; 10,000 lb., \$81·1.

One paper, on central-station promotion of electrical vehicle use, seems to indicate that station engineers have adopted a non-committal attitude on the question up to now, and, further, points out the serious competition of the petrol passenger and freight vehicles, the latter, in particular, having to be faced as soon as the abnormal export business falls away. The author, Mr. W. P. Kennedy, however, believes that the electric vehicle would unquestionably obtain the preference if a flat price per annum were offered for garage service covering upkeep and maintenance in constant working condition.

A paper on greater garage service, by Mr. Salvat, deals, in breezy language, more especially with the grievances of the Chicago garages and the misleeds of the electric-vehicle manufacturers, who, according to this writer, are playing into the hands of the gasoline car makers. This paper gives one a glimpse of the "human nature" side of business, and is well worth reading on that account alone.

A paper on battery service, by Mr. Wagoner, refers to the Hartford Electric Light Co.'s battery service system, some particulars of which have already appeared in our pages; it appears that the General Vehicle Co. co-operated in establishing the system—in which an essential feature is the purchase of electric power by "the mile run"—and has since established similar service in Spokane, Boston, Baltimore, Harrisburg, San Francisco, Los Angeles, Worcester, Fall River, and Wichita, while many other cities are prospective users.

A paper on the electric passenger vehicle problem, by Mr. Chalfont, is a plea for a more rational understanding of the present scope of this type of car. The author points that the electric passenger car is capable of performing fully 95 per cent. of the demands made upon the gasoline car, "but that little 5 per cent. stands up in the sky like a steeple on a church," and is responsible for the sale of a million gasoline cars a year. The writer proceeds to show that this small percentage represents problematical advantages, and to demonstrate how users can be educated as to the true state of affairs.

Other papers deal with the industrial truck and its troubles, and the relation of tires to efficiency, and all of them contain something of interest to electric-vehicle men.

Tilling-Stevens Petrol-electric Fire Escape.

Through the courtesy of Messrs. Tilling-Stevens, Ltd., of Maidstone, we are able to illustrate one of the petrol-electric fire-escape ladders which they have supplied to the London Fire Brigade.

The Tilling-Stevens petrol-electric drive has been referred to on several occasions in our pages, but we may point out that this equipment consists of a 40-H.P. four-cylinder engine, direct-coupled, through a flexible coupling, to a generator which energises a series-wound motor, the latter driving the back axle through a propeller shaft and worm gearing. The generator, by means of simple switchgear, is used to supply the power requirements of the ladder for elevating and training it, when not required for propulsion.

The generator is capable of an output of up to 30 KW., at speeds varying from 350 to 1,400 R.P.M., and pressures varying from 0 to 300 volts; the machine has a falling characteristic, so that any increase in the current taken by the motor is accompanied by a corresponding reduction in voltage. Thus on the level the demand for current is small, and the voltage high and favourable to high vehicle speed, while on an up-grade, opposite conditions prevail—the motor speed decreases, but the torque increases.

The diagram on page 641 shows the whole of the electrical connections and controlling devices.

Reversibility is obtained by change in the direction of the current in the motor field through the controller-switch. The speed of the vehicle is controlled by means of the throttle-pedal in conjunction with the generator and motor field resistance.

The output of the generator can be reduced practically to zero by lowering the engine speed on the throttle and inserting resistance in the field by means of a resistance lever.

Tilling-Stevens Petrol-Electric Fire Escape; Ladder Extended.

Forward movement of the lever causes the contact drum to cut out resistance until the full field is obtained, and further movement puts in circuit a graduated resistance which shunts the motor field. A two-way shunt switch enables the field winding to be connected directly across the dynamo armature when it is required to supply current for the ladder; when current is required for propelling the vehicle, the shunt circuit is completed through the controller and motor field to the other side of the generator, and in this position when the controller is in the neutral position, the shunt circuit is broken. This prevents the motor from being started up suddenly.

When it is desired to operate the ladder, the controller is placed in the neutral position, the shunt changed over to the ladder position and the S P. main switch closed. This energises an electrical solenoid governor which regulates pressure to the desired voltage independently of the load. The D.P. switch for the ladder motor circuit can then be closed and the ladder raised, elevated and trained by means of the motors and regulators contained in the base of the ladder turn-table.

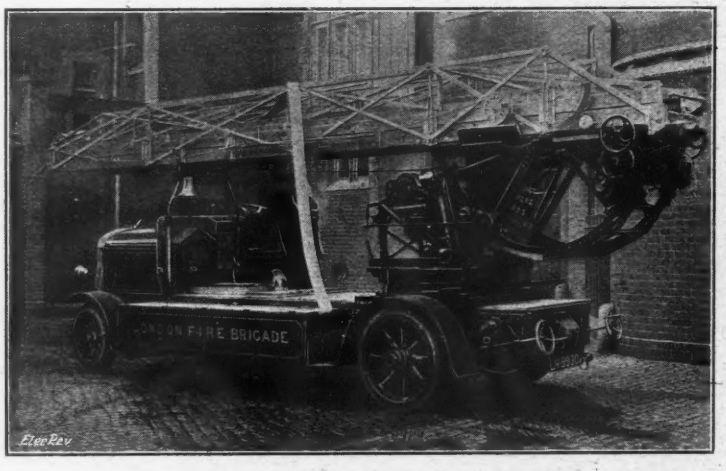
It may be of interest to record that the Tilling-Stevens petrol-electric vehicles have found extensive use with the naval and military services for running searchlight projectors, operating travelling workshops and for signalling purposes. They have also been employed privately for operating arc-welding plants, supplying temporary lighting and in connection with cinematograph apparatus. In view of the above list of uses, it is almost unnecessary to add that a self-contained travelling petrol-electric combination of the type mentioned is invaluable for many industrial applications, when its utility as a goods carrier and for haulage is also taken into account.

In conclusion, we may add that Messrs. Tilling-Stevens are also builders of an "all-electric" chassis, of the industrial type, suited for loads of 3 to 4 tons, and to run 30 or 40 miles on one charge, at a speed of 10 to 12 miles an hour.

Armstrong-Whitworth Road Train Fitted with Thomas Transmission.

It may be remembered that a few years ago a road train was designed by a French engineer, Colonel Renard, and a number of road trains were constructed in this country under his patents. A mechanical power shaft ran throughout the length of the Renard train, and provision had to be made for overcoming the unevenness of the drive, due to the varying angles at which the vehicles might be placed in relation to one another when moving on uneven surfaces, and turning corners. This necessitated the use of spring drives, universal joints, and numerous bearings, all of which made the system complicated, costly, inefficient and unreliable.

A few years ago a German firm, Messrs. W. A. Th. Müller, placed on the market a train which might be termed an "all electrical train." In the Müller train the leading vehicle carried a powerful internal combustion-engine and generator, from which current was transmitted to motors driving all the wheels of the train. Such a train, consisting of 11 vehicles in all, capable of carrying as much as 50 tons with axle weight not exceeding 5 tons, was shipped to Australia three years ago.

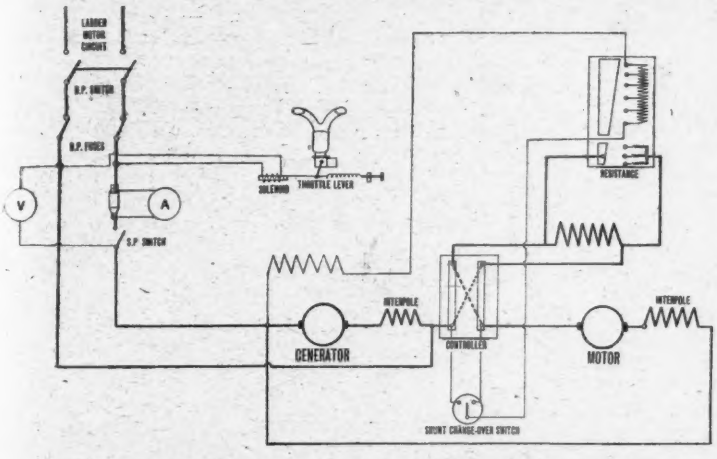


Petrol-Electric Fire Escape, showing Ladder Turntable.

The views we give relate to a train which is entirely the product of British brains and work. It was recently built by Messrs. Sir W. G. Armstrong, Whit-

Tilling-Stevens Petrol-Electric Fire Escape.

worth & Co., Ltd., who, to avoid the disadvantages of the "all mechanical" and "all electrical" systems adopted the with only a portion of the power for a relatively small portion of the whole running time, it is comparatively light and cheap.



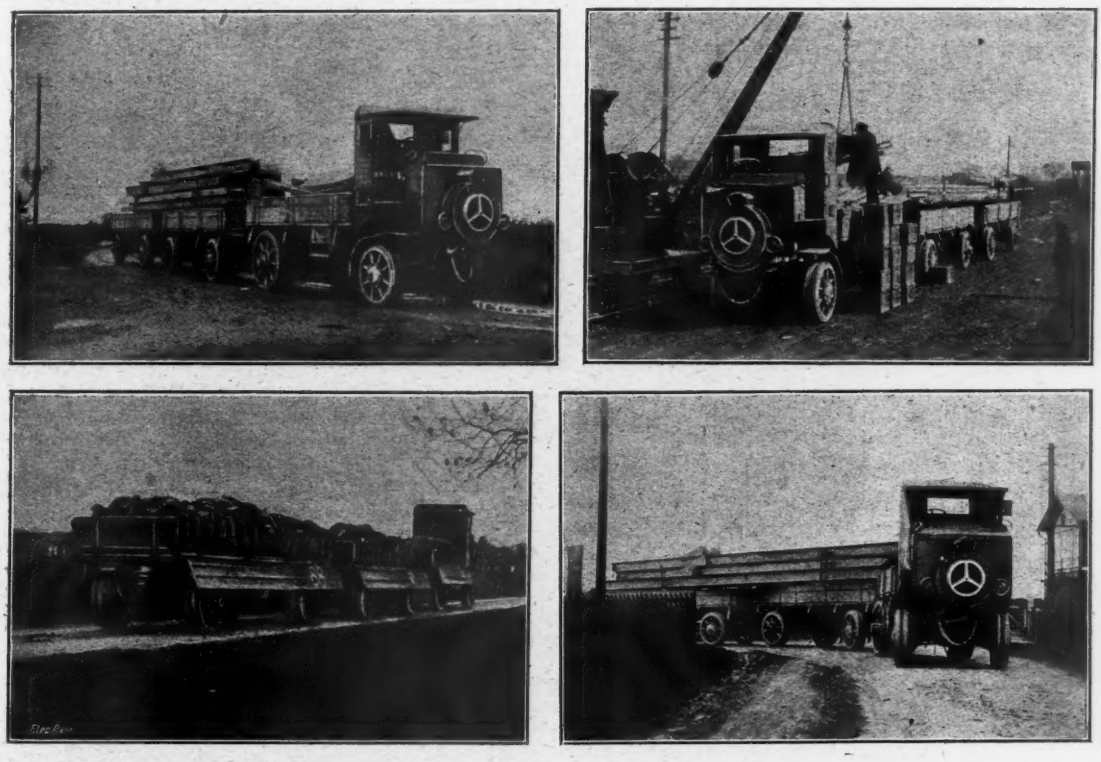
Electrical Connections, Tilling-Stevens Fire Escape.

We have before us particulars of a non-stop 210-mile test with a gross load of 30 tons, in which the train illustrated put up a record of 77-ton miles per gallon of petrol, and this in spite of wet roads and 10 hours' night travelling during the test.

The train is now carrying loads of 25 to 30 tons of the kind illustrated, the material carried being used in the construction of a large factory in the North.

It can be operated conveniently by two men, and in an emergency one man is sufficient. All the wheels are steered, and the facility with which the train can be backed out of awkward places or round corners is remarkable, the wheels following in the same track in either direction of travel.

All the wheels of the leading vehicle are braked by direct mechanical means in the ordinary way, whereas the brakes on the

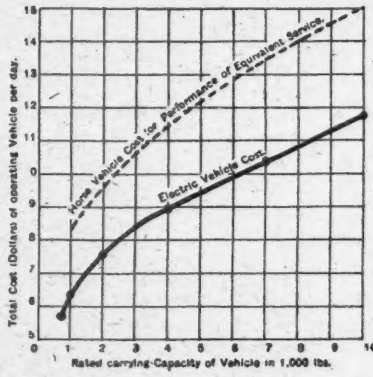


Typical Views of a Road Train fitted with Thomas Electro-Mechanical Transmission.

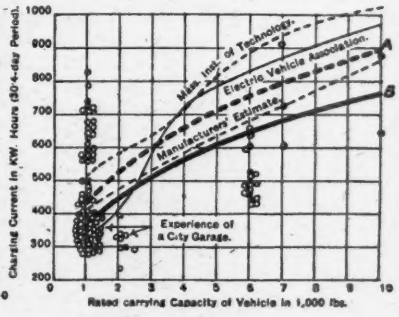
electro-mechanical system known as the "Thomas Transmission."

In previous issues of this paper we have from time to time referred to the Thomas system; briefly it is a combination of an electrical with a mechanical system of transmission, whereby the power is transmitted partly electrically, but mainly mechanically. The portion of the power transmitted mechanically in the case of a road train is confined to the leading vehicle, while the electrical portion is easily transmitted to the trailers and controlled from the leading vehicle.

As in other applications of the Thomas system the electrical transmission is cut out on top drive; the electrical apparatus is used only when large tractive effort is required, *i.e.*, when starting from rest, when travelling on bad roads, and when climbing grades, and since it deals trailers are electrically operated by means of solenoids, the necessary exciting current being controlled by a switch


Total Cost (Dollars) of operating Vehicle per day.
Horse Vehicle Cost for Performance of Equivalent Service.
Electric Vehicle Cost
Rated carrying-Capacity of Vehicle in 1,000 lbs.

Curve No. 1.—Operating Cost of Electrical Trucks.



Curve No. 2.—Charging Current for Electric Trucks.

within reach of the driver. By means of an electric controller, 15 speeds in either direction are provided.

The train illustrated is equipped with an engine developing 75 H.P., at 1,000 R.P.M. It will run continuously at 12 M.P.H. on ordinary macadam roads, and if the surface be extra good, can be speeded up to 15 M.P.H.

On account of the large single-power unit, the efficient drive, and the relatively low tare weight, the fuel and other expenses of such a train will be very much less than that required by a number of single lorries to handle the same load.

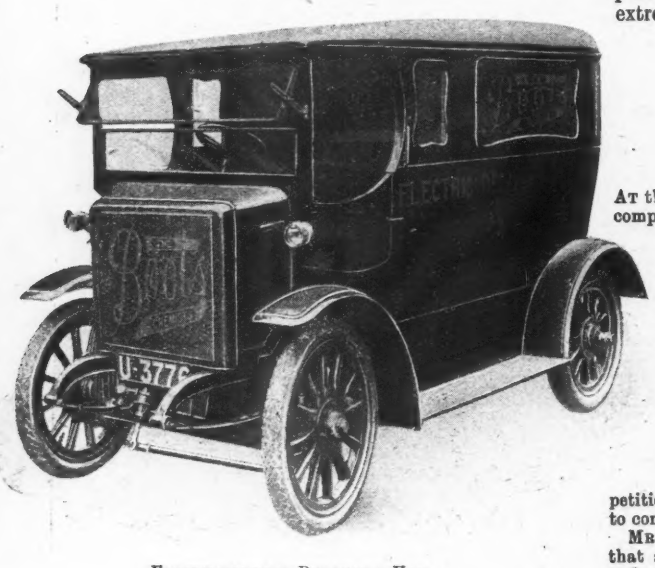
In conclusion, we are indebted to the Thomas Transmission, Ltd., for the foregoing particulars and views.

Electromobile Delivery Vans.

Messrs. Electromobile (Leeds), Ltd., have recently constructed two 15-cwt. delivery vans for Messrs. Boots, the well-known chemists, the general appearance of these vehicles being shown below. These are built with a similar chassis to that described in the Electrical Review of March 3rd, last; the battery is of the "Ironclad" type, consisting of 40 eleven-plate cells, allowing a travelling radius of 40 miles per charge.

Pedal resistance and drum control, operated by means of a lever underneath the steering wheel, are fitted.

The vehicles have a speed of 14 miles an hour, and in addition to their expeditious delivery work, provide an excellent advertisement for Messrs. Boots. We may add, as tending to show the simplicity of operation of such a



Electromobile Delivery Van.

vehicle, that the driver of one of them was able to commence his regular duties on the day after he ceased driving a horse-van.

A Battery-driven Recruiting Van.

Messrs. Drake & Gorham's Manchester branch, some time ago, supplied a standard Edison G.M. 2-ton electric vehicle to the Liverpool Corporation Electricity Department, and during the vigorous recruiting rallies in connection with the Derby scheme, Mr. Dickinson, the city electrical engineer, had a special recruiting body fitted, as shown in our view, the vehicle being in regular use for evening recruiting marches. The battery supplies a number of electric lamps fitted inside the body to illuminate the lettering, and the result was a very effective appeal.

The vehicle has now been in constant use on its ordinary duties for over a year, and has effected a very considerable economy in the cartage work of the department. It is employed largely in connection with mains extension work, and, in addition to the actual saving in the cost of carting (which, we understand, amounts on an average to between £7 and £8 per week), a further advantage is afforded by the reduction of time spent by gangs of men in reaching their work, as, apart from carrying the cable and other materials required, the car transports the mainsmen, labourers, and tools to the required locality with a minimum of delay.

Mr. Dickinson states that during the twelve months that the vehicle has been in use, it has covered 10,000 miles at

HIS MAJESTY THE KING
APPEALS FOR RECRUITS
FOR THE ARMY FOR THE PERIOD OF THE WAR
GOOD PAY AND CONDITIONS OF SERVICE
REMEMBER THE LUSITANIA AND NURSE CAVELL
GOD SAVE THE KING
RECRUITS ARE REQUESTED TO FALL IN AT REAR OF COLUMN
RECRUITS WANTED

Liverpool's Electrical Recruiting Van.

an average current consumption of 0·7 unit actual input to the battery. Repairs and replacements have been practically *nil*, so that the total operating costs have been extremely moderate.

LEGAL.

Colston Electrical Works Co., Ltd.

At the Bristol County Court, his Honour Judge Stanger made a compulsory winding-up order in the case of this company.

Mr. Haslam, who appeared on behalf of the petitioning creditors, Messrs. Haslam & Stretton, of Cardiff, said the facts stated in the petition were not disputed, and he thought he was entitled to the winding-up order asked for. A short time ago the company approached the largest creditors, and asked them to agree to the petition being withdrawn, in order that the company might be wound up voluntarily. The company passed a resolution for voluntary winding up, and appointed Mr. A. Collins as liquidator on May 23rd. They stated that, provided that course was agreed to, outside people would provide a sum sufficient to pay 12s. 6d. in the £. His clients felt that if they got 12s. 6d. in the £ it would be as much as they expected. He did not withdraw his petition, though he thought the matter was one for the creditors to consider.

Mr. Weatherly, who appeared on behalf of the creditors, said that assuming that the meeting alluded to was regularly called, and assuming that 12s. 6d. in the £ was guaranteed, he would support the petition for compulsory winding up, on the simple ground that the assets would realise more than the liabilities.

Mr. Tayler, who represented the company, said the position of the company was this: The Simplex Conduit Co. claimed about £500. They issued process, got judgment, and put in an execution, which enabled them to reduce their claim to about £90. In view of what the Simplex Co. did, his clients sought the protection of the Court, and the Official Receiver was appointed liquidator to protect the assets. When the largest creditors were approached with a guarantee of 12s. 6d. in the £, on condition that the present petition was withdrawn, it was in the interest of the creditors that the application should not be proceeded with. If his Honour would not dismiss the petition, he suggested an adjournment, so that the matter could be further discussed. If the assets were worth more than 20s. in the £, the creditors would be paid in full. The company had got into its present position simply because it could not collect its debts.

Mr. Weatherly contended that it was just one of those cases which ought to be investigated by the Court. From the figures supplied to him by the Official Receiver, the assets, which had already realised £420, were likely to yield £960 to meet liabilities of £797.

His Honour made the order asked for.

Victoria Falls and Transvaal Power Co. *v.* Van Breda.

On April 10th, in the Transvaal Provincial Division of the Appeal Court, Mr. Justice Bristowe allowed the appeal of the company from a decision of the magistrate, who, while finding that there was serious and wilful misconduct on the part of the defendant,

awarded £500 as compensation for his death. Van Breda was an electrician, admittedly experienced and competent, employed at Rosherville station, and he was killed on April 18th, 1915, by an electrical discharge at one of the transformers. Mr. Justice Bristowe, in reviewing the matter as considered by the magistrate, said that the magistrate was not entitled to infer, in face of evidence to the contrary, from the mere fact that a permit was signed, that the deceased in entering a live cubicle was acting with the knowledge and approval of Powell, the foreman electrician. Until the permit had been shown to the deceased and he had signed the declaration he could not know that the cubicle was dead. The fact that there were breaches of the regulations by other officials did not prevent the act of the deceased being so regarded. While one had the fullest sympathy with the defendant's wife and young child, one was not entitled to stretch the law in his favour. The appeal must be allowed, and the judgment altered to one of absolution from the instance, and the appellant would be entitled to costs in both Courts. The other judges concurred.

A WALFORD BODIE "OVERDOSE."

A TAILOR'S presser has been awarded £25 damages against "Doctor" Walford Bodie. Defendant was giving one of his entertainments at the Gaiety Theatre, Birmingham, and plaintiff took hold of the handles of the battery, under the defendant's assurance that he would come to no harm. He was thrown to the ground, and became unconscious for a few seconds, the audience laughing all the while. The County Court Judge said that plaintiff had suffered from an overdose of the current. A man who had a battery like that, and represented to the audience that it was safe, should exercise a high standard of care to keep the current under control, and see that no harmful results happened. He had not done that in this case. Stay of execution was granted.

THE EFFECT OF VACUUM FUSION UPON THE MAGNETIC PROPERTIES OF IRON.*

BY TRYGVE D. YENSEN.

IN a number of articles during the last two years the writer has described the remarkable magnetic properties obtained by melting electrolytically refined iron *in vacuo*. It has been shown that it is possible by this process to obtain magnetic permeabilities as high as 50,000, accompanied by hysteresis losses of $\frac{1}{5}$ to $\frac{1}{8}$ those of the best commercial transformer steels in use at the present time. The question has naturally arisen: What effect will the vacuum treatment have upon commercial grades of iron? In order to answer this question, one of the purest grades of commercial iron obtainable was selected for an investigation; this iron was made by the open-hearth process according to the most approved method.

Test pieces were prepared from the iron as it was received from the manufacturer, and others were prepared from the iron after its being re-melted *in vacuo*. These test pieces, before the final testing, were annealed at 1,100° C. *in vacuo*, and cooled at the rate of 30° C. per hour to room temperature.

The results obtained are given in the accompanying table and

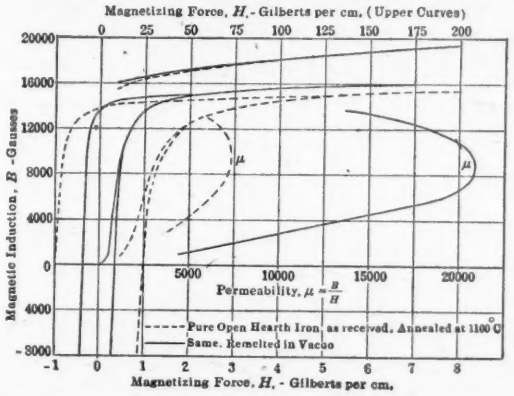


FIG. 1.—MAGNETIC TEST CURVES OF PURE OPEN-HEARTH IRON AS RECEIVED AND AS RE-MELTED IN VACUO.

in fig. 1. It is seen that the vacuum treatment has increased the maximum permeability from two to three times, and decreased the hysteresis loss by a corresponding amount.† For the sake of comparison, there have been included in the table results previously obtained with electrolytic iron—with and without additions of silicon—melted *in vacuo*. This comparison shows plainly that nearly as good results are obtainable with pure open-hearth iron as a base as with the pure electrolytic iron.

* From *Metallurgical and Chemical Engineering*. Abstract.

† A similar improvement has been obtained with Swedish charcoal iron.

As far as the chemical analysis is concerned, it is difficult to point out any material difference between the open-hearth iron before and after the vacuum treatment. Only as far as the CO and CO_2 gases are concerned it may be stated that there has been a material reduction by the vacuum treatment. Density tests showed very slight differences between the treated and untreated iron, but the density of the vacuum-treated iron was in every case found to be higher, the average difference being about 0·1 per cent.

Photomicrographs show that in the untreated iron, while it is remarkably free from slag or other impurities such as are generally met with in commercial iron, there appear a large number of minute spots, evidently cavities caused by dispelled gases. The vacuum-treated iron is practically free from such cavities, and the crystals of the treated iron are much larger than those of the untreated iron.

The results seem to indicate that the purer the iron the larger are the crystals. Previous results also point towards a possible connection between high magnetic permeability and large crystals when comparing irons of the same general composition and having received the same mechanical and heat treatment. It may be a question, however, whether magnetic permeability has anything to do with the crystal size, as it may depend solely upon the purity of the iron. In favour of this contention may be cited the fact that when pure iron has been annealed at temperatures above 900° C., followed by slow cooling, the resulting crystals are much smaller than after annealing at or below 900°, and yet the magnetic permeability is generally increased by annealing at the higher temperatures.

From these facts and indications the only safe conclusion that may be drawn is that the open-hearth iron has been purified by the vacuum treatment to a degree not obtainable by any ordinary process of manufacture; and, furthermore, that this purification has resulted in marked improvements in the magnetic properties. Together with the results previously obtained with Swedish charcoal irons, these results show definitely that it is possible to obtain magnetic properties with commercial grades of iron by vacuum fusion that are comparable with those obtainable with electrolytic iron.

TABLE I.

Kind of specimen.	Maximum permeability.	Density for maximum permeability.	Permeability. B = 10,000	Permeability. B = 15,000	Hysteresis loss, ergs per cb. cm. per cycle. B = 10,000	Hysteresis loss, ergs per cb. cm. per cycle. B = 15,000	Retentivity in gausses. B = 10,000	Retentivity in gausses. B = 15,000	Coercive force in Gilberts per cm. B = 10,000	Coercive force in Gilberts per cm. B = 15,000	Spec. elec. resist., microhms.
Open-hearth iron, as purchased. Machined from ½-in. rod. Annealed at 1,100° C.											
Rod	7,250	10,000	7,250	2,710	—	5,560	9,000	13,000	·85	1·0	10·15
Open-hearth iron re-melted *in vacuo*, annealed at 1,100° C.											
Rod	14,180	8,500	13,200	5,350	1,080	2,190	8,700	12,300	·37	·40	10·05
Ring	17,000	9,000	16,700	8,250	852	1,755	8,400	12,600	·28	·33	—
Rod	10,900	9,000	20,200	7,500	865	1,760	9,300	13,600	·30	·34	10·20
Electrolytic iron melted *in vacuo*, annealed at 1,100° C.											
Rod	25,800	9,000	25,600	1,365	707	1,451	9,300	12,700	·23	·28	9·85
Electrolytic iron, with 0·15 per cent. Si melted *in vacuo*, annealed at 1,100° C.											
Rod	66,500	6,500	41,700	6,000	286	916	9,080	12,000	·09	·165	11·80
Electrolytic iron, with 3·0 per cent. Si melted *in vacuo*, annealed at 1,100° C.											
Rod	72,600	9,000	69,500	2,500	254	926	9,400	13,700	·09	·16	44·75

Russian Electricity Tax.—A meeting of the Indirect Taxes and Monopolies Committee was held on May 13th, with A. I. Nikolaienka, Assistant Minister of Finance, in the chair. The tax on electrical energy was considered. According to the scheme of the Minister of Finance, it was proposed to put a tax on electricity used for lighting and for industrial purposes, the general tax for private lighting to be at the rate of 4 copecks (1d.) per KW.-hour, and that for street lighting 1 copeck (¼d.). Energy for industrial purposes is to pay 2 copecks (½d.), and for certain auxiliary industries ½ copeck (half-farthing). The representatives of industry said that to put a tax on electricity used for industrial purposes might very prejudicially affect the development of the country's productivity; but most of the Committee, including Profs. Bernadsky, Migulin and Tugan-Baranopsky, found such a tax to be quite admissible if moderately applied, the more so as such an indirect tax would be transferred by the producers to the consumers. Prof. Migulin raised the question of the monopolisation of the production of electrical energy. It was decided to submit this important question to a Special Financio-Economic Committee. The Committee approved the project of the new law.

D

THE ELECTRIC LIGHTING OF SMALL TOWNS.

BY H. N. MUNRO.

(*Abstract of paper read before the* JUNIOR INSTITUTION OF ENGINEERS.)

THE idea is prevalent in the lay mind that an electric undertaking will not pay unless developed on a large scale, and that to attempt to put down an electric generating station and provide electric light and power in a place of less than 10,000 inhabitants is to court disaster. This impression is entirely erroneous; villages with populations as low as 500 have found that it is a profitable venture to follow the times and use electricity in place of oil or gas. These concerns are not only self-supporting, but they manage to yield dividends of 2½ to 5 per cent., and sometimes more after a year or two of working, some of the more successful yielding 10 per cent. after a few years. It is, of course, essential that such concerns should be most economically run in order to keep expenses down and, at the same time, to maintain a reliable and efficient service.

It is well to bear in mind when contemplating the promotion of any such schemes that there will always be a certain amount of local opposition which must be overcome.

In opening up negotiations, the best plan is to interest and obtain the support of two or three prominent residents in the place, these preferably being tradesmen or members of the local governing body. The next thing to do is to call a meeting to which all interested are invited. Prior to this, a judicious distribution of literature stating the case for electricity will arouse interest sufficient to ensure a good representative attendance at the meeting, when the objects and scope of the undertaking can be clearly explained.

Assuming that the support of the inhabitants is assured, it will now be necessary to ascertain how far the local authorities and governing bodies may be expected to favour the scheme officially. This is most important. Assuming that consent is given by the governing bodies concerned, the formation of a company can be proceeded with immediately. There are many schemes of this nature working without any Provisional Order. The obtaining of a Provisional Order is a lengthy and often an expensive matter, and it places on the undertaker many responsibilities. The only substantial benefit to be got from it is permission to break up roads and streets for the purpose of laying cables, and also the securing of compulsory wayleaves; the breaking up of roads is unnecessary, as all mains are run overhead, and wayleaves are not very difficult to obtain when the support of the residents in the place is given to the undertaking. Furthermore, the Provisional Order does not convey a monopoly of electric supply to a company as is commonly thought, since the local authorities can give their consent to any other undertaker to provide an electric supply.

If at all possible, neighbouring villages should be induced to fall in with the proposals, and these should be grouped together, as this will be found to reduce costs per unit and management expenses, besides being conducive to more efficient service.

The company should be well supported locally if it is to be successful, and the majority of the shares should be held by the inhabitants of the locality. The articles of association should contain clauses relating to the selling of fixtures, wiring of premises, and extent of supply in order to give the company full scope for extension. The company should start with full capital and entirely free from all obligations and loans. If sufficient money cannot be obtained at the outset to purchase outright all plant, &c., arrangements can sometimes be made by which contractors will agree to accept shares in the company as part payment.

For a small town of, say, 5,000 inhabitants, a sum in the neighbourhood of £4,500 is necessary to provide plant and mains. A good average figure for load per 1,000 of population is about 12 KW., and the town under consideration will therefore require plant able to generate some 60 KW., which, at an average figure of £35 per KW., gives a sum of £2,100 for plant alone. A substantial brick and galvanised iron building may cost in the neighbourhood of £400, giving a total of £2,500 for plant and building.

In such a town as is here discussed, a mains length of four miles is a fair figure to take. This, carried on wood poles with bare copper conductors at 230 volts on the direct-current two-wire system, would cost approximately £400 per mile, making a total of £1,600 for mains. This would include services, protective apparatus, and house meters. A sum of £50 should be sufficient to cover legal expenses.

The odd amount of £350 should cover contingencies, thus bringing the capital, in round figures, to £4,500. Full powers should be obtained when the company is formed to increase the declared capital, if necessary, by a sum of, say, £1,500 to cover the cost of future extensions, &c.

An average number of 20-watt lamps per house or shop being assumed, the estimated possible load can be arrived at. For residential districts 60 per cent. of the estimated possible load may be taken as the maximum load on the feeders, and for shopping areas a percentage of 80. The next step is to divide the area into districts, each served by a feeder. The feeder termination point should be as near the power station as possible, but at the same time should be centrally situated in the district.

The distributors should be as few as possible, and each one should take in as many consumers as is practicable.

Each feeder, at its termination, should be adequately fused, as should each distributor leading from it. The fuses should be contained in cast-iron weatherproof boxes, and mounted high up on the pole.

Post Office telegraph or telephone lines must be protected from contact with the power lines by guard wires. At the station end of each feeder is a lightning arrester.

While most of the overhead work of this nature is carried out with wood poles, such as are used by the Post Office for telegraph lines, steel poles are occasionally used, presenting a better appearance. They are, however, about three to five times as costly as wood poles, are more difficult to erect, and cost more for maintenance than wood poles. Good wood poles well creosoted should last from 25 to 30 years, and under ordinary conditions require very little maintenance. Light poles used for carrying very small conductors along a straight route are from 22 to 30 ft. long, and about 6 in. diameter at top and 9 in. diameter at the bottom. For medium conductors poles are used about 25 to 35 ft. long, 8 in. at top, and about 10 in. at the butt. Stouter poles are used for heavy conductors and for corner or terminal positions where heavy strain is encountered.

For supporting the line, either wood or iron arms are used, or malleable cast-iron brackets. The insulators used are similar to those adopted by the Post Office on telegraph lines. Ironwork should be well galvanised, and all exposed screw portions should be coated with a tallow mixture. Poles and other woodwork should be well creosoted or impregnated with some preservative material, and poles or arms, when drilled or cut in any way after impregnation, should be treated with a coating of hot tar or other preservative solution at the parts affected.

The plant for a power supply in a large city has to be supremely efficient; cost is, to a certain extent, a secondary consideration. The small plants with which this paper is concerned are dependent, to a great extent, on low initial cost. Superlative efficiency is not required, but the plant must be reliable, strong, and simple to work, as skilled drivers and attendants are not readily obtainable in small places.

The type of plant largely depends on circumstances. If good coal is cheap, and plenty of water is obtainable, a self-contained steam plant is worthy of consideration. Some types of this plant are exceedingly efficient and possess a comparatively high overload capacity. With careful attention stand-by losses can be kept low. A suitable steam plant may be obtained for about £9 to £10 per B.H.P. The average space required for a small town station is about 7 or 8 sq. ft. of floor space per B.H.P. The fuel consumption of such engines ranges around 4 to 5½ lb. of coal per unit generated.

The gas engine and producer is a popular plant, and can be run very economically. Stand-by losses are not very great; cheap fuel can be utilised, and an abundant water supply is not necessary. It pays to use a fairly good anthracite coal in the form of peas. This ensures a clean gas being generated comparatively free from tar, and reduces cleaning costs.

An efficient horizontal gas plant consumes about 2 to 2¼ lb. of anthracite per unit generated, and the cost, including producer plant, averages £8 to £9 per B.H.P.

Oil engines are an extremely satisfactory plant to deal with, provided they are well chosen and attended to carefully. The crude-oil engine is most frequently met with in small power stations for this work. This plant costs in the neighbourhood of £8 per B.H.P., and consumes about 1½ pints of crude oil or paraffin per unit generated. The space occupied is about the same as that of a steam plant of the same rating.

Shunt-wound generators are used, controlled by a shunt regulator, with properly designed steps. With low-speed engines a belt drive is usual, while direct coupling is resorted to in case of high-speed engines. A booster is used in stations where a battery is installed.

In such installations as are here considered the plant during the day has but little load to provide for. A reliable battery of adequate capacity should be installed. The maintenance of the battery is very important, and is usually undertaken by the suppliers under a maintenance contract.

A deciding factor in these schemes is the cost which must be borne by the householder in order to be able to use electricity. Unless it is absolutely certain that the arrangement is a sound one, free wiring should not be undertaken; it is better to have a small number of consumers entailing very little expense than a large number whose wiring has to be supplied at a heavy cost. A very satisfactory job can be carried out in wood casing at a cost of about 12s. per point. It is a very good plan for the company to have a separate department for the sale and hire of fittings. A meter rental of about 4s. to 5s. per annum is charged. A "penny-in-the-slot" meter is used in some places for the poorer class of consumer.

The disadvantage of the meter system is that a man must be employed to read the meters. The great advantage of the meter is that the station engineer can obtain valuable records which are indispensable to a progressive undertaking, and the consumer can see what units are actually supplied and charged for.

The method of charging by contract presents little or no

difficulties in the way of operation. It requires no meter reader and no meter, and involves less clerical labour. It is open to the objection, however, that no records are available of each consumer's actual consumption. Of the two systems, the author favours the charging by meter. The lamps mostly used are 15, 20, and 25-watt, and an average of 12 lamps per building may be taken.

In a town of 5,000 inhabitants a reasonable installation to expect is in the neighbourhood of an equivalent of 1,000 lamps of 20 C.P. each for the first year's working. In a well-managed place this should easily be about doubled during the second year. In a great number of these small places gas or oil is the only illuminant, the gas being sometimes as high at 6s. or 7s. per 1,000 cu. ft. Electrical energy may be supplied up to 8d. per unit, 6d. being a good average to take, which compares favourably with gas at 3s. 6d. per 1,000 cu. ft. —a very low rate for a small town.

It is usually possible to enter into a contract with the local authorities for the electric lighting of the whole or part of the main streets; a reasonable price for this is about £3 per lamp per annum. While in many cases a dividend is yielded as the result of a first year's running, it would be unfair to base one's estimate of working on this year. In the second year the scheme has had a good chance to develop, and may be reasonably expected to be running normally.

The private lighting may be taken to comprise 1,800 20-watt lamps, the public lighting 100 3/40-watt lamps. The following figures are based on these assumptions:—

Expenditure.	£	s.	d.
68,040 units at 1d.	283	10	0
Management expenses	525	0	0
Total expenditure	£808	10	0

Revenue.	£	s.	d.
Private lighting—28,800 units at 6d. per unit	720	0	0
Street lighting—100 lamps at £3 each per annum	300	0	0
150 meter rents at 5s. each per annum ...	38	0	0
	£1,058	0	0

The profit is therefore £250. Of this amount £1,500 debenture or preference shares will absorb their dividend of 5 per cent., totalling £75. The balance of £175 remains to satisfy the ordinary shareholders and any reserve or other fund which is contemplated. A dividend of 5 per cent. can be paid on £3,000 ordinary shares, leaving the sum of £25 to be placed to reserve.

The foregoing figures are representative of what may be met with in actual practice. No notice has been taken in this paper of power loads or requirements or of any profit which may accrue from the sale of fittings, lamps, &c., which, after a few years' working, may amount to a substantial sum.

An average dividend of 5 per cent. has been figured from the statistics of ten companies, with populations varying from 2,500 to 10,500, which shows that such undertakings are paying concerns.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Metric System.

We have had long enough to wait for that very practical and economical reform—Daylight Saving—an idea originated by a Briton, but only adopted by Great Britain after almost every other European country. Shall we also be the last to benefit by that equally great, or greater, commercial reform, the substitution for our present weights and measures of the international metric system, the idea of which was also originated by a Briton?

For years the Decimal Association has urged the reform of our coinage and weights and measures to those on a decimal basis, and the prospects for the success of our work are now hopeful. I shall be pleased to send further particulars to anyone applying to me at Finsbury Court, Finsbury Pavement, London, E.C.

E. Merry, *Acting Secretary,*
The Decimal Association.

London, E.C., *June 3rd*, 1916.

Decimal Coinage.

"W.M.M.'s" reply is far from edifying in its criticism of my note. It is to such men as he that we owe our present backwardness in commerce and, to a certain extent, in science. These iconoclasts whose policy is to destroy where others construct belong to a class which, were it not so prevalent, one could well afford to ignore—always ready to magnify infinitesimal errors, while they themselves sit on the fence and watch others struggle. The slip of the pen which "W.M.M.'s" eagle eye spotted would have been obvious to any schoolboy, and allowed for as such.

"W.M.M." should remember that the system of which I wrote is, and has been, in practical use for nearly ten years all over the globe, and has "worked" with unfailing success during that period.

The imaginary coin, the speso, with its practical unit the spesmilo, 2s., has been scientifically designed in order to give the closest approximation possible to the standard coins of different countries.

By the way, has it occurred to "W.M.M." that *all* foreign coins are imaginary as far as *we* are concerned? A franc or mark is simply imagined by our contractors, and its relative value in English currency ascertained.

Unless "W.M.M." is mad (this is not an aspersion) he will not deny that the French decimal coinage system works O.K.; yet has he, or any other man, ever seen in modern French currency a centime piece, of which the French "penny" is a multiple or 10? The same remark applies to many other foreign "imaginary" units. What is needed is an international system to link them up, and the Esperanto spesmilo system supplies this need. Ours is about the only European country which has not made a move in the matter. Why, oh why, is England so inert?

Alfred Bridges.

London, W., *June 3rd*, 1916.

Economy in the Use of Coal.

The figures given by Mr. Horace Bowden in the letter which appeared in your issue of May 26th, advocating the universal substitution of electricity in place of gas for lighting and power purposes, are very misleading, owing partly to his somewhat over-estimating the efficiency of electric lamps and motors and under-estimating that of gas burners and engines, and partly to his leaving a very important factor out of consideration—that of residuals.

From every ton of coal carbonised in a gas works there is a residuum of 10 cwt. of coke for sale; so that, even if it takes two tons of coal to produce the same total candle-power by gas as one ton of coal will produce by electricity—and that is an outside estimate—the *net* consumption of solid fuel is the same in both cases. But then there must be taken into account the tar and ammoniacal liquor resulting from the distillation of the coal, residuals from which (1) our Navy and Army are deriving invaluable ingredients for the manufacture of high explosives, (2) a host of industries obtain chemicals that are vital to their existence, and (3) the farmers of this and allied countries derive one of the most important of all artificial fertilisers.

All these precious materials go up the chimney at an electric generating station, unless gas engines are used to drive the generators!

Mr. Bowden's figures regarding the relative usage of coal to produce H.P.-hrs. by the gas engine and the electric motor need material correction, as I have said; but even taken as they stand, and amended by the factor of residuals, they show an advantage as to fuel economy in favour of the gas engine. Corrected to a true comparison of efficiencies the balance in favour of the gas engine is very marked.

Mr. Bowden is seeking fuel economy in the wrong direction. It lies, rather, in putting coal through the retort as a prelude to obtaining from it the motive power for the generation of electric energy.

D. Milne Watson, *Managing Director,*
The Gas Light and Coke Co.

London, S.W., *June 3rd*, 1916.

The I.E.E. Rules.

These days of warfare may not be a suitable time for criticism of the new Wiring Rules issued by the Institution of Electrical Engineers. Electrical contractors have already noted difficulties and defects in the matter and arrangement of some of the rules. The revised rules must themselves be revised. So much is clear. The object of this letter is to recommend that the Wiring Committee begin preparations for a revisal as soon as the war work permits. I would suggest, also, that there should be added to the Committee the names of some wiring experts well known for their prolonged effort to raise the standard and the status of this branch of electrical work.

The majority of the Committee should be men whose work has been mainly wiring. Many engineers eminent in other branches undervalue the importance and complexity of wiring problems and practice.

Engineer.

June 3rd, 1916.

[Our correspondent appears to be deeply dissatisfied with the new Rules and refers to "difficulties and defects," but does not enter into particulars. It would be interesting and useful if he would specify the nature of his complaints in detail. We may remind him that the Wiring Rules Committee of the I.E.E. is a Standing Committee, and invites suggestions.—EDS. ELEC. REV.]

WAR ITEMS.

After-the-War Trade.—In the House of Commons last week, Sir R. Cooper complained that the Board of Trade was too slow in tackling the question of trade after the war. It was unfortunate that there should be an impression in the country that many of the Committees which had been set up to deal with the matter were packed juries. Now was the time to get rid of the German octopus.—In reply, Mr. Pretyman said that the Board of Trade was alive to the situation which would arise in regard to labour when the war ended. He said, according to the *Morning Post* report, that the matter had been considered from the outbreak of the war, and he believed the arrangements which had been formulated would go a long way towards solving the problem when it arose. Before the war the tendency of trade was in the direction of international and cosmopolitan combinations. We looked upon this as a purely trade matter—we assumed political and trade honesty in the Germans. But there was behind this action on the part of the Germans a political object and, indeed, a dishonest trade object. One knew how agencies had been captured by Germans, and German goods gradually substituted for British. The Board of Trade had done a good deal to counter that. The Board of Trade were getting rid of, and closing down, the German element in British trade. One element which was most difficult to get rid of was when German agencies had practical control of the output of some product of pivotal character. It was necessary that this country should have the plant and material ready at the end of the war to combat this. The labour to make and erect such plant, far less to operate it, was difficult to procure. But the Board recognised that the country must be ready to be self-supporting at the end of the war, if we were not to lose our opportunity. If the gates had once again to be opened to an uncontrolled supply of vital products he could not see how they were to be closed again.

Exemption Applications.—At Batley, the managing director of a local firm of electrical engineers applied for exemption for himself as being in a certified occupation. He was regularly employed in the work of electrical fitting, and had suffered great depletion of staff. He had been an active member of the local Volunteer Corps from the beginning. Conditional exemption granted.

At Windsor, Mr. Fowler, electrician, who appeared in R.N.A.S. uniform, applied for exemption for his only adult employé. Mr. Fowler stated that he himself had joined, leaving the man appealed for in charge of the business. If this man left there would be no electrician in the town, and the business would close down. Three months' exemption allowed.

Windermere Tribunal, after considering appeals by Messrs. J. K. & Ernest C. Thornburrow, electrical engineers, granted the former six months' exemption and the latter one month.

Dover Tribunal has granted conditional exemption to G. Hopkins (32), coal and ashes trimmer at the Corporation electricity works, and six months to E. Smith, driver for a Corporation electric refuse vehicle.

Dartford Tribunal has refused exemption to a coal trimmer appealed for by Mr. Pember, electrical engineer to the U.D.C.

At Chatham, on May 30th, exemption was claimed by the Tramway Co. for 35 men, it being stated that if any more had to go things would become very serious. Before the war there were 234 men and 17 boys, but all the latter and 145 of the former had left, and the staff now consisted of 124 men, 28 boys, and 72 female conductors. The Tribunal gave conditional exemption to 22 motor-men, one engineer, and one repairer of electrical mains; three months to a clerk and a stoker; two months to a pavior and a night timekeeper; and one month each to a clerk, a night foreman, a chief motor inspector, and two truck-men. The other appeals failed.

Nuneaton Tribunal has granted exemption until August 1st to E. Burgoyne (29), the only man, out of seven, left with Mr. Harold Birch, electrical engineer.

At Torquay, conditional exemption has been granted to Mr. J. M. Keenan, deputy electrical engineer, and Mr. A. E. Williams, chief clerk at the electrical works.

At Macclesfield, a local firm sought exemption for their electrical engineer, and said that it was impossible to obtain a qualified man over military age. The company supplies a number of business concerns with current for manufacturing purposes, and it was stated that if the engineer went the supply might have to be curtailed, as the staff had now reached the absolute minimum. Three months' conditional exemption was allowed.

Tunbridge Wells Tribunal has granted three months' conditional exemption to Messrs. R. J. Spittles and R. F. Rack, electrical wiremen with Messrs. Strange & Sons.

The Chipping Norton Electric Supply Co., Ltd., appealed to the County Tribunal for Mr. G. G. Bates, shift engineer, claimed to be indispensable to the maintenance of the borough supply. The Local Tribunal considered that Mr. Bates was not wholly indispensable, and that he could be replaced by a man over military age. He had been "starred," but this was removed on May 11th. The Court declined to interfere with the Local Tribunal's decision, but gave the company a month in which to find a substitute.

At Bedford, Mr. R. W. L. Phillips applied for exemption certificates for 20 men at the borough electricity works. It was explained that although the men had been exempted they were being called up by the Recruiting Officer. The Tribunal decided to issue the certificates.

Before the West Kent Appeal Court, Messrs. T. White and Bushell, electrical engineers, of Chislehurst, appealed for Mr. H. S. White (28), as being indispensable to the business, but no exemption was allowed.

The Barnstaple Tribunal has granted conditional exemption to Mr. Frank Bickford, electrician, who had been passed for sedentary work only, and who supervises motors, &c., at local works.

At Canterbury, on May 29th, the city electrical engineer, Mr. C. A. Blascheck, appealed for three men engaged at the dust destructor, and said that there were now only six men instead of 12, and they could work with only one shift. Conditional exemption was allowed.

Chelmsford Tribunal has granted three months' exemption to F. J. East (40), who attends to the electric light installation at the residence of Mr. R. A. Ellis, J.P., of Stock.

Eastbourne Tribunal has given two months' exemption, with leave to appeal again, to an apprenticed electrician with a local firm, whose indentures have still two years to run, and who is the only one of the former staff of seven electricians left.—The proprietor of an electrical engineering business in the town has been exempted until the end of June.

At Hoddesdon (Herts), Messrs. Christie & Co., Ltd., appealed for Mr. W. R. Stone, electrician, responsible for supplying light for 100 men and the offices, and also to several houses in the town. He was exempted whilst he remains in his present position.

Woking Tribunal heard an appeal for five indispensable employés of the Accumulators, Ltd., of Maybury. S. F. Bates, foreman of the carpenters' shop and woodworking mill, was refused exemption, it being considered that he could be replaced; three months' each were allowed to E. H. Cooper, foreman of the assembling and formation department; A. A. Blatcher, foreman of the mixing and pasting department; R. H. Simpson, foreman electrical fitter; and P. D. Hollings, manager and analytical chemist. The same Tribunal has given three months to A. M. Dallen, chief clerk, and A. J. Jameson, meter tester, repairer, and reader, with the Woking Electric Supply Co., and one month to Mr. A. Gill, the company's accountant.

The Aylesbury Rural Tribunal has given three months' exemption to the electrician engaged at Hartwell House.

Oldham Tribunal has refused exemption to three married brothers, partners in the firm of Caton & Sons, electricians, ten of whose staff have enlisted. Three electrical fitters with Mr. J. Jackson, electrician, of Oldham, have been exempted until August 1st.

The military appealed against three months' exemption allowed to a charge-hand at the Rugby U.D.C. refuse destructor, who has been on the staff for ten years and is thoroughly conversant with the work. It was claimed by the surveyor that in the interests of health the work should be done efficiently. The exemption was allowed to stand, but it was intimated that it might not be renewed so easily.

The Peterborough Tribunal has granted six months' exemption to Mr. T. C. G. Clabburn, manager of the Peterborough Electric Traction Co.

At Rochdale, an electrical engineer, Mr. W. Pickard, aged 29, who was stated to be engaged in developing a patent, was granted temporary exemption till the end of August.

At Blackpool Tribunal, on June 1st, a local hydro company appealed for their engineer and electrician, aged 32. There were 1,100 lights in the hydro, the plant being under the control of this man. Conditional exemption granted.

Conditional exemption was granted by St. Annes Tribunal, on May 31st, to the chief electrician of the tramway company, and to two engine drivers at the electricity works.

The proprietors of the Royal Mills, Esher, applied to the Tribunal for their electrician to be exempted, he being the only one of the original staff left. Exemption granted until November 20th.

The Dartford Tribunal has granted exemption to Mr. S. W. Botterill, electrical engineer to Messrs. Swaislands, of Crayford.

At the Stockton-on-Tees Tribunal, on May 30th, an application was made for the exemption of Coun. H. C. Watson, manager of the electrical department of the firm of Messrs. T. B. Watson & Son, sanitary and electrical engineers; the department was turning out work for controlled firms, and so many men had joined the Colours that it would be impossible to carry on the business without Mr. Watson. Three months' exemption was granted, with leave to appeal again.

At Fleetwood, an electrical engineer who sought exemption for himself and for two of his employés, produced documents showing that he was fitting wireless to the mine sweepers, and regularly repaired electrical machinery on the boats. He was also engaged on electrical work for the Government and for firms outside the town who were on Government work. The applicant was granted conditional exemption. The other men were exempted till September 30th, and the employer was advised to get badges for them.

Ashby-de-la-Zouch Rural Tribunal has refused exemption to the man in charge of the electric light plant at Measham Hall, the seat of Sir W. Abney.

Before the West Kent Appeal Court, on Monday, Mr. H.

Williams, assistant manager of the Erith U.D.C. electricity works, appealed for Leonard Clarke (31), engineer-fitter's mate. Conditional exemption was allowed.

At Castleford, Mr. C. J. Cox, electrical engineer, appealed for his working manager, Mr. Ralph Sheard (28), and said that without him he would be unable to carry on the business. His other men were gone, and Mr. Sheard was the only man in the town who could do certain repairs at the works in the district. Exemption was allowed whilst he remains in his present occupation.

At Batley, the managing director of a local firm of electrical engineers, who said that, owing to the depletion of the staff he was regularly employed in the work of an electrical fitter, was granted conditional exemption.

The Aysgarth Tribunal has granted conditional exemption to an attested employé of the Askrigg Electric Light Co.

An attested farmer, butcher, and proprietor and manager of a "public electric light supply" at West Burton was granted conditional exemption.

The Economic Conference.—The Marquess of Crewe will attend the Paris Economic Conference in place of Mr. Runciman, President of the Board of Trade, who is suffering from a breakdown consequent upon the great strain of his manifold duties.

Breach of Lighting Order.—At Accrington, on June 1st, R. P. Gerland, electrician, was fined 7s. 6d. for a breach of the Lighting Order. Defendant had been carrying out electrical work in Whalley Road, and had omitted to switch off one of the lights when leaving.

Coal Trade Committee.—The President of the Board of Trade has appointed a Committee, consisting of the Rt. Hon. Lord Rhondda (chairman), Mr. A. E. Bowen, Mr. Newton Dunn, Mr. F. J. Jones, Mr. A. Nimmo, Mr. A. F. Pease, Sir Daniel M. Stevenson, Bart., and Mr. R. Wharham, to consider the position of the coal trade after the war, with especial reference to international competition, and to report what measures, if any, are necessary or desirable to safeguard that position. Mr. J. U. Smith, of the Board of Trade, will act as Secretary.

To be Wound-up.—The Board of Trade has ordered the following to be wound-up:—

Krupka & Jacoby, Ltd., 26-36, Chapter Street, Westminster, S.W. Importers of electric light fittings, &c. Controller: Thomas Wise, Bassishaw House, Basinghall Street, E.C.

Trading with the Enemy.—The "London Gazette" for June 2nd contains further lists of persons and bodies with whom trading is prohibited in Argentina, Bolivia, Chile, Norway, Peru, Spain, Sweden, Portugal, and other countries.

BUSINESS NOTES.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—A very fully illustrated brochure of between 80 and 90 pages describing Curtis turbo-generators has been issued by the company. The descriptive matter is very detailed, and is accompanied by half-tone pictures of various parts of the plants and many views of complete sets, line diagrams and curves, and photographs of the works at Rugby. Altogether it is a very fine production and will be of service to power station engineers, consulting engineers, &c.

MESSRS. T. W. BROADBENT, LTD., Victoria Electrical Works, East Parade, Huddersfield.—Leaflet No. 1 of a new catalogue which is being issued in sections. The "D" type generator for continuous current is described in this leaflet.

MESSRS H. TINSLEY & CO., Eldon Park Works, South Norwood, S.E.—Two pamphlets: No. 44 (12 pp.) contains a description with prices, &c., of the Drysdale-Tinsley non-inductive low resistance standards or "shunts"; No. 47 (12 pp.) deals with optical testing instruments, Dr. Drysdale's field glass and telescops testing apparatus, &c.

MESSRS. PARMITER, HOPE & SUGDEN, LTD., Hulme Electrical Works, Manchester.—Advance copy of a new catalogue of 52 pages, in which fully illustrated and exhaustive information is given respecting the Fluvent fuse system, which is being largely used in the new munitions factories put up by the Government. "Fluvent" switch fuses, power centre boards, glands, &c.; "Ajax" ironclad switches and fuses, mining switches, fuse-holders, small power distribution boards, lighting fuseboards, and bi-metal fuse wire, are among the manufactures covered. A number of pages are occupied with shipping weights and dimensions. The firm have now an office in London (Queen Anne's Chambers), where samples of the Fluvent system can be seen.

To Develop Export Trade.—M. Crozier, the French commercial attaché in Belgium, Holland, Switzerland, and Scandinavia, advises certain modifications in present methods of securing trade in these countries. The union of producers is a leading point in his advice. Considering that the bigger firms stand in no need of his recommendations, he limits his remarks to the smaller firms engaged in turning out articles of restricted consumption, or "seasonal" articles, or to those afraid or hesitating to make a start in the export trade. To these he tenders the advice to combine or group their resources and efforts. It is, he says, a *modus operandi* found efficacious by our enemies. Such selling syndicates should combine from one to two dozen merchants or manufacturers of articles suitable for the same class of customers, but each firm different and non-competitive with other members of the same group or combine. The components of the group should be wisely studied; the number of its members happily limited, so as to help the work of agents and representatives, and assure a sufficient remuneration, so that none may think their interests sacrificed; such groups working in the foreign country chosen either by means of an agent sent direct and settled on the spot and holding local stocks, or by a resident representative of the country, recommended by, say, the French Foreign Trade Office. The choice of this agent or representative should be the subject of great care: he should be capable, intelligent, of credit in the country, and furnish every guarantee of integrity, serious business, mental acumen, and pro-French sympathy. On the other hand, it should be made possible to assure him a suitable position and a remunerative volume of business. At a pinch, resort might be had to commission firms, but these have the faults of occupying themselves with too great a variety of articles, buy from any French or foreign firms, and neglect the little known articles which it is the object of the group to export. Lastly, the attaché recommends the trial and employment of French women already trained in commerce, so as to leave the the men free for industrial occupations.

U.S. Electrical Exports in February.—The U.S. electrical exports for the month of February established a new record. The previous record of last November was exceeded by nearly $168,000. An increase of over $1,259,000 occurred as compared with February, 1915. For the four electrical classes for which numbers of articles exported are given in the official reports, there were shipped in February the following:—Electric fans, 1,872; arc lamps, 112; carbon-filament lamps, 86,471; metal-filament lamps, 580,667.

	Feb., 1916.	Feb., 1915.
Batteries	$104,712	$109,214
Dynamos or generators	112,965	127,565
Fans	30,637	10,206
Insulated wire and cable	217,764	95,641
Interior wiring supplies, &c. (including fixtures)	133,500	67,648
Lamps—		
Arc	1,761	8,031
Carbon-filament	12,898	9,862
Metal-filament	107,715	51,373
Meters and other measuring instruments	59,170	22,807
Motors	439,769	326,224
Telegraph instruments (including wireless apparatus)	2,542	5,589
Telephones	105,176	101,957
Transformers	86,414	46,646
All other	1,527,588	700,804
Total	$2,942,611	$1,683,567

In February there were also shipped 19 electric locomotives valued at $134,405; these are not included in the above table.

For the eight months ended February 29th, 1916, the total value of electrical exports was $18,581,180; for the corresponding period ended February 28th, 1915, the total was $12,205,421; for the corresponding eight months of 1913-14, it was $17,723,804.—*Electrical Review and Western Electrician.*

Pay Wallets.—An ingenious pay wallet has been devised by MESSRS. MARTIN BILLING, SON & CO., of Livery Street, Birmingham. It consists of a sheet of stout paper, ruled for a statement of gross and net wages, and deductions for insurance, &c., so arranged that on folding it with Treasury notes and loose cash inside, and sealing two flaps, the coins can be inspected through perforations and the value of the notes ascertained, yet nothing can be withdrawn from the wallet without tearing it open. Thus there can be no dispute as to whether the wallet contained the correct sum when handed to the workman, as the latter can check the amount and return the wallet unopened if he is dissatisfied. The workman's name and number and the statement of wages can be read without opening the wallet. The device should prove very useful in safeguarding against loss by error or fraud, and preventing disputes.

Book Notices.—"The Year-Book of Wireless Telegraphy and Telephony for 1916." London: Wireless Press, Ltd. Price 3s. 6d. net.

"Science Abstracts." A and B. Vol. XIX. Part 5. May 25th, 1916. London: E. and F. N. Spon, Ltd. Price 1s. 6d. each section.

"The Economical Use of Coal." By John H. Anderson, Purfleet. From the Author: price 1s. post free.

The *Faraday House Journal* for the Summer Term contains a further list of students serving in the allied forces, biographical and obituary notices, and examination results for 1916, as well as the usual personal items, &c.

Bankruptcy Proceedings.—G. E. BONNER, electrical agent, Palmer's Green.—June 21st is the last day for receipt of proofs for dividend. Mr. E. W. J. Savill, trustee, 14, Bedford Row, W.C.

F. C. POULTON, consulting and inspecting engineer, Eccles.—June 21st is the last day for receipt of proofs for dividend. Mr. J. G. Gibson, trustee, Byrom Street, Manchester.

For Sale.—The County Borough of Barnsley has for disposal two 75-KW., high-speed, D.C., direct-coupled, generating-sets. See our advertisement pages to-day.

Dissolutions and Liquidations.—LAKE & CURRIE, consulting engineers, Norfolk House, Laurence Pountney Hill, London, E.C.—Messrs. H. W. Lake and D. Currie have dissolved partnership.

EASTON LIFT CO., LTD.—This company is winding up voluntarily, with Mr. H. G. Holmes, 33, Paternoster Row, E.C., as liquidator. A meeting of creditors is called for June 15th, at Express Works, Southwark.

BRITISH AND COLONIAL LIGHTING CO., LTD.—A meeting is called for July 7th, to hear an account of the winding up from the liquidator, Mr. C. W. Rooke, 46, Queen Victoria Street, E.C.

AMERICAN ADDING MACHINE CO., LTD.—A meeting is called for July 7th, at 18, St. Swithin's Lane, E.C., to hear an account of the winding up from the liquidator, Mr. D. L. Honeyman.

WESTON ELECTRIC LAMP CO., 1 and 3, Sun Street, Finsbury, E.C., electric lamp factors and agents.—Messrs. C. S. Engzelius and J. S. Nunn have dissolved partnership. Mr. Engzelius attends to debts, and continues the business.

Trade Announcement.—MESSRS. BERRY, SKINNER AND CO. announce that in future the address of their head offices will be "The Switch House," 86, Newman Street, Oxford Street, W., where extensive premises have been acquired. Telegraphic address, "Ptolemaist Ox., London"; telephone Nos., "Museum 3310 and 3311."

Lamp Discounts.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Upper Thames Street, E.C., have issued a notice withdrawing the 7½ per cent. preferential discount on Wotan, half-watt, and tantalum drawn-wire lamps, as from June 1st, owing to the increased cost of raw material and labour, and the difficulties arising from the shortage of both.

LIGHTING AND POWER NOTES.

Aberdeen.—The total number of units generated during May at the Corporation electricity station amounted to 1,213,870, an increase of 285,360 units over the preceding month; an application has been received from a local shipbuilding firm for a power supply, and that the Electricity Committee has approved a recommendation that the firm be supplied with 400 H.P., on a three years' guarantee of energy consumption. A three-phase E.H.T. supply will be given to a sub-station in the yard.

Accrington.—The Tramways and Electricity Committee has decided that the whole of the fire insurance of its depôt shall be undertaken by the Corporation's own fire insurance fund.

The borough treasurer reports that of £26,250 borrowed under a sanction of June, 1900, for the electrical undertaking, provision for repayment had been made to the extent of £25,655 up to March, 1916, leaving a balance of £595.

The Electricity Committee has decided that the sum of £1,000 be repaid to rate funds during 1916-17, which will leave the balance owing at £3,558.

Barrow-in-Furness.—YEAR'S WORKING.—The report of Mr. Burnett, the borough electrical engineer, on the working of the Corporation electricity undertaking for the year ended March last, discloses an exceptionally prosperous state of affairs. Whereas in the previous year the units sold totalled 3,597,410, the total for 1915-16 reached 13,806,254 units, an increase of 10,208,844 units in the year. Of this total, over 12 million units represent power supply. The maximum load was 3,905 KW., and the load factor 40·36 per cent., these comparing with 2,285 KW. and 17·97 per cent. in 1914-15. Considerable increases were also shown in the lighting and tramway supply, but naturally public lighting units show a large reduction. The effect of this abnormal increase in power units, sold at an average price of ¾d. per unit, on the finances of the undertaking is of considerable interest. The revenue during the past three years was made up as follows:—

	1913-14.	1914-15.	1915-16.
Private lighting, &c. ...	£11,310	£13,286	£14 350
Power and heat	3,432	7,692	38,929
Public lighting	1,467	1,426	1,151
Traction	3,492	3,709	4,233
Meter rents, &c.	448	472	545
Total receipts	£20,149	£26,585	£59,208
Total costs	£11,460	£13,867	£34,809
% costs to receipts	56·87	52·16	58 79
Gross profits	£8,689	£12,718	£24,399
% gross profits to capital expenditure	6·68	8·55	14·80
Working costs per unit ...	1·32d.	·92d.	·605d.
Average price per unit ...	2·27d.	1·74d.	1·02d.
Net profit	£513	£3,163	£12,804

Some 382 motors of 2,760 H.P. are now connected to the mains, 94 being hired, and hired apparatus for heating and cooking has also attained respectable proportions. In regard to the domestic use of apparatus, Mr. Burnett mentions that the average consumption of a large number of domestic consumers in one district is now three times what it was four years ago. During the year 723 new consumers were connected, and although many represent workmen's dwellings, the number of lamps added amounts to 63,067 30-watt lamps.

As regards working conditions, Mr. Burnett points out that increased price of coal represented no less than £6,000 or ·087d. per unit sold. Nearly 95 per cent. of the total output was generated by two turbo-alternators, which have run practically continuously, frequently overloaded, month after month, and demonstrated the reliability of this type of plant. The large increase in output was only rendered possible by the E.H.T. scheme carried out three years ago, when capital charges amounted to ·94d. per unit, as against ·20d. now.

In concluding, Mr. Burnett points out that capital repaid, revenue expenditure of a capital nature and renewals fund amount to 44 per cent. of the total capital expenditure; the whole of the balance of net profit, after meeting certain expenditure, has been placed to renewals.

The report is of great technical interest and is worth careful study.

Birmingham. — YEAR'S WORKING. — With further reference to the report of the Corporation electricity department for the year ended March 31st last, during the year the capital account was increased by £145,652. On buildings, including the ferro-concrete work and railway sidings at Nechells permanent station, and the cooling tower foundations at Summer Lane and small additions at sub-stations, £22,373 has been expended; the greater part of the £72,928 expended on machinery has been incurred at the Nechells temporary station, retention money on turbo-alternator and cooling towers at Summer Lane, and switchgear and converters at the Parker Street, Bordesley and Saltley sub-stations.

Mains and services cost £50,830. The total number of units sold, as compared with the previous year, was as follows:—

	Units sold.	
	1916.	1915.
Low tension—		
Lighting	9,064,172	8,726,306
Power	27,479,308	21,460,141
High tension	53,169,118	28,536,161
Tramway supply ...	27,303,723	24,186,574
Total	117,016,321	82,909,182

The output for lighting and power, exclusive of tramways, shows an unusual increase, the units sold being 52·8 per cent. higher than in the previous year. This is due to the large amount of power taken by manufacturers on Government work. The increase in the output for the tramway supply was 12·9 per cent. The balance of the revenue account, £191,283, represents the gross profits of the undertaking.—*Birmingham Daily Post.*

Blackpool.—YEAR'S WORKING.—According to figures presented to the Finance Committee, on June 1st, the electricity department made a profit last year of £2,478, and expects to make a profit this year of £2,000; and the tramways department made a profit of £16,275, and this year expects to make £10,000 profit.

The Electricity Committee has decided that no further applications for supply under the ratable value tariff be accepted during the war.

Bolton.—The Electricity Committee having received a letter from the B. of T. (railway department) calling attention to the question of possible economy in national resources that could be effected by a system of interconnection of electrical supply undertakings, the engineer has been requested to prepare a report on the matter.

Bradford.—PROPOSED PLANT EXTENSION.—The Electricity Committee has recommended the City Council, in view of the ever-growing demands upon the electricity department, to make application for sanction to borrow £100,000 for the purpose of extending the plant.

Canada.—An agreement has been entered into by the City of Edmonton, with the Alliance Trust Co., of Calgary, for a temporary supply of power until the new hydro-electric plant of the Edmonton Power Co. is ready for operation.—*Canadian Electrical News.*

Continental.—GERMANY.—The Daylight Saving scheme has brought some trouble in its train in Germany, for we learn that the leading electricity supply company in Berlin declines to recognise the new "summer time," and that it will not switch off the current furnished for hall and corridor illumination until 10 p.m., as hitherto, *i.e.*, what is now 11 p.m., and will charge accordingly. It justifies its action by the cost of re-adjusting its switching-off system, which would have to be re-altered in the autumn.

SPAIN.—Application has lately been made for a concession to establish a plant to utilise the water power of the river Toran, near Canejan (Province of Barcelona), in the generation of electrical energy for lighting and power purposes in the district.

Plans have been prepared for a new electricity generating station at Medina de Pomar (Province of Burgos). The water power of the river Nela will be utilised, an application having been made to the Spanish Government for the necessary concession.

A concession has lately been granted for the establishment of a plant to utilise the water power of the river Segas, near Tojos (Province of Santander), in the generation of electrical energy for lighting and power purposes in the district.

FRANCE.—The present and future of the hydroelectric industry in the French Alpes region is set out in a recent issue of the *Revue Electrique*. The region embraces one-tenth of the total area of France, and includes the departments of Haute-Savoie, Savoie, Isère, Drome, Hautes Alpes, Basses Alpes, Vaucluse, Bouches du Rhone, Var, and the Alpes-Maritimes, and the basins of 37 rivers. The installed water-power in December, 1910, of this region amounted to 473,000 H.P., which had increased by December, 1915, to 738,000 H.P., or by 255,000 H.P. in the five years. The utilisation of this power in the latter year was industrially subdivided in H.P. as follows:—Power and light, 291,000; metallurgy, 255,000; electrochemistry, 147,000; traction, 10,000; saw-mills, paper-making, wood-working, 30,000; sundry (lime, cement, weaving, &c.), 8,000 H.P. The number of electric works in 1910 was 126, and in 1915, 205, or an increase of 79 in the five years. Their capacity varied as follows:—Up to 100 H.P., 9 in 1910 and 26 in 1915; 101 to 500 H.P., 43 and 70 respectively in the two periods; 501 to 1,000 H.P., 14 and 19; 1,001 to 5,000 H.P., 30 and 43; 5,000 to 10,000 H.P., 17 and 19; and 10,000 H.P. and upwards, 13 and 28 in the years 1910 and 1915 respectively. The electric plants of 500 H.P. and under mostly furnish light to small localities, whereas those above that figure are allied to large industries. The constant calls for energy, as well as the demand created by the increasing scarcity of imported coal, have created a situation such that the distribution companies constantly find themselves unable to meet demands. In consequence, many important undertakings for the utilisation of waterfalls are being taken in hand, and the next quinquenium's advance is likely to more than equal that of its predecessor.

ITALY.—A society has been formed at Turin with the title "Comitato Torinese per lo Sviluppo Hidroelettrico," which, as in the case of the Associazione Elettrotecnica Italiana, is intended to further the utilisation of Italy's water resources by hydro-electric plants. Influential personages and bodies in the Province of Piedmont have joined the board.

The Società Anonima Lugugnanese has been formed at Portobuffolé, with a capital of 35,000 lire, to supply electric current in an area which includes the town of Lugugnana. The Society proposes to purchase energy.—*Revistà Tecnica d'Elettricità.*

Exeter.—PRICE INCREASE.—The T.C. has decided to increase the charge for electricity for lighting from 4d. to 5d. per unit, as from July 1st next. It is estimated that the Daylight Savings Bill will reduce the income by £500, while restricted street lighting means a reduction of £1,350 for the year.

Finchley.—PRICE INCREASE.—The D.C. has decided to increase the price of current for private lighting by 20 per cent. in lieu of the increase of 10 per cent. previously decided upon. The increased price will apply after the June quarter. The price of current for power purposes will also be increased as from the above-mentioned date as follows:—(*a*) Consumers with a load factor of 33¼rd per cent. or less, by 10 per cent.; (*b*) exceeding 33¼rd per cent., the increase to be the percentage amount of the excess fuel cost over ·9d. per unit generated, with a limit of 10 per cent. It is also proposed to suspend, on and after August 1st next and during the period of the war, the clause of the general conditions of supply relating to free service connections.

Glasgow.—YEAR'S WORKING.—The electricity department has achieved a record output for the year ending May 31st, consequent largely upon the huge demands for power made by the different factories, shipyards and other establishments engaged on national work. The output for 1915-16 amounted to 130,000,000 units against 104,000,000 units in 1914-15, while the revenue was £500,000 against £400,000 respectively, an increase approximately of 30 per cent. So great was the demand that an overload was carried throughout practically the whole winter, a state of affairs which would have been obviated had the new works at Dalmarnock—a portion of which would have been in operation, but for shortage of labour and material—been ready.

Grimsby.—The Public Lighting Committee is recommending the T.C., in view of the fact that in the current year £966 has been taken from the reserve fund of the electricity undertaking to pay for extensions of mains and services, for which no loans are available, to transfer the whole of the balance of net revenue (£640) to the reserve fund.

Ilford.—REFUSE DESTRUCTOR REPORTS.—The question of utilising the steam from the destructor works has formed the subject of recent reports from the Council's officials. The surveyor estimates that some 75,000 lb. of steam per day should be available, and Mr. Shaw, the borough electrical engineer, describes three schemes by which this could be utilised in supplying electricity, giving respectively 551,000, 735,000, and 1,200,000 units delivered at the Ley Street works. For reasons given, either the first or second scheme is preferred, both involving the transfer of machinery from Ley Street to the destructor. Mr. Harvey, the tramway manager, says it is evident that neither of the first two schemes would alone provide the requisite energy for the tramways, and that the third scheme could not be carried out under present conditions.

Ilkeston.—SALE of E.L. AND TRAMWAYS.—The Tramways and Electricity Committee has recommended the Corporation to accept the offer of the Notts. and Derbyshire Power Co. to take over the tramways and electricity undertakings on certain terms. The matter has been considered by the Council as a General Purposes Committee, and it was decided, by a large majority, to sell the undertakings, and the resolution to that effect will be submitted to the ordinary meeting of the Council for confirmation. The tramways have been in existence for 13 years.—*Sheffield Telegraph.*

India.—The Karachi Cantonment Committee has decided to light the streets by electricity.—*Indian Engineer.*

Keighley.—HOSPITAL LIGHTING.—The Keighley and Bingley Joint Hospital Board last week decided upon an installation of electric lighting in the permanent hospital buildings, at a cost of £216.

Lancaster.—YEAR'S WORKING.—The report of the Council's electricity department shows an income of £10,170, against £9,111 in 1914-15; the expenditure increased by £1,865, coal accounting for £1,119. While there was a decrease in lighting, there was an increase of 160,346 power units. For the first time since 1896, there was a deficit amounting to £393—less than anticipated, and met from the reserve fund, which now stands at £3,561.

Leek.—The U.D.C. has received the report of Dr. Watkinson, of Liverpool, on the breakdown at the electricity works, and it is being considered in conjunction with the report of the Council's own engineer.

Leyton.—STREET LIGHTING.—The Highways Committee of the D.C. has agreed to the electric lighting department's proposal to make a charge of £10 per lamp per annum for lighting arc lamps converted for incandescent lighting. The department is making no charge for carrying out the conversion, the cost of which is estimated at £100.

Liverpool.—The Corporation has been recommended by the Finance Committee not to approve the resolution of the Tramways and Electric Power and Lighting Committees to increase the pay of certain of their employés by ½d. per hour, but that a war bonus of 1s. 6d. per week should be given to all men in the Corporation employ on certain conditions.

Llanfyllin.—STREET LIGHTING.—The T.C. has decided to accept the offer of Mr. R. A. Jones to light the streets by electricity at £2 per lamp for 21 lamps, for a period of one year, subject to renewal; the town clerk is to prepare the agreement.

London.—HAMMERSMITH.—The L.C.C. has sanctioned the borrowing by the B.C. of £3,000 for electrical extensions, under the usual war conditions.

WESTMINSTER.—With reference to the amended terms for the supply of current to the City Council's buildings by the Charing Cross Co., the Council has been recommended to agree that the contract should be for one year ending June 24th, 1917, determinable at the end of that period, or on any quarter-day thereafter, by three months' notice.

Maidstone.—PRICE INCREASE.—The T.C. has adopted a new scale of charges for current, which are some 25 per cent. above the original prices.

Reigate.—The T.C. has decided to further overdraw the electric lighting capital account to the extent of £231, in order to enable certain work to be carried out for increasing the capacity of the two sub-stations. It was stated that the heating and power supply had increased 36·25 per cent. up to March last.

Rochdale.—PLANT EXTENSION.—Although the formal sanction of the L.G.B. has not yet been given to the expenditure of £10,157 on extensions at the electricity works, it is reported that an intimation has been received that the sanction will be given, and, acting on this, contracts for the work have been let.

Salford.—The Electricity Committee recommends the T.C. to agree to a reduction of 2½ per cent. in the normal contract charges for the supply of energy to the works of Messrs. R. Haworth & Co.

The Committee has decided to temporarily delete Clause 31 (relating to penalty for late completion of contracts) of the Model General Conditions of the I.E.E. from contracts entered into on such conditions.

South Africa.—The Cape Provincial Council has passed an ordinance whereby it will hereafter be lawful for any undertaker of a public electrical supply to supply electrical energy outside the area of a local authority, subject to the consent of the Administrator being obtained. The immediate object of the ordinance is to enable the Municipality of Oudtshoorn to supply electric lighting to the Divisional Council of the district, so that the Cango Caves may be illuminated.

Spenborough.—YEAR'S WORKING.—There is a loss of £152 on the Council's electricity undertaking for the past year, as compared with £600 for the previous year. This is considered satisfactory in view of the fact that there was an extra expense of £138 over which the Council had no control.

Sunderland.—YEAR'S WORKING.—The last year's working of the Corporation electricity department resulted in a revenue of £71,102, including £37,304 from power supply. After meeting working expenditure a balance remained of £30,636, and after providing for interest and sinking fund charges, the balance of £1,032, being net profit, was carried to renewals. The output sold amounted to 15,056,376 units, an increase of 3·84 per cent.; the load factor also improved from 26 to 31 per cent. The manager, Mr. Blackman, refers to narrow margin of plant capacity, and points out that the breakdown of a generator had led to estimated additions to working cost of £3,500.

Wisbech.—Price Increase.—The T.C. has agreed to allow the Electricity Supply Co. to increase the price of energy for lighting to not more than 6½d. per unit, owing to the great increase in the cost of fuel.

TRAMWAY and RAILWAY NOTES.

Blackpool.—Electric Vehicle.—The Finance Committee has sanctioned the purchase by the Cleansing Committee of a second electric water-sprinkler, at a cost of about £1,000.

Bolton.—Electric Vehicle.—A deputation from the Electricity Committee having recommended the advantages of electrically-propelled vehicles, the Waterworks Committee has decided that it will consider the views put forward by the deputation when the question of motor transport is next before the Committee.

Female Labour.—The tramway manager reported a difficulty in obtaining suitable labour for car cleaning in the night time, and has been authorised to employ women for the work. It was reported that 154 employés of the department were serving with the Colours and 18 had still to go. Forty women conductors were now employed.

Glasgow.—Year's Working.—The official returns of the last year's working of the Corporation tramways show that the traffic receipts amounted to £1,149,264, an increase of £178,570 on the previous 12 months. The passengers numbered 362,371,464, an increase of 26,110,706, and the car-mileage was 24,963,309, an increase of 748,849. The receipts per car-mile were higher, although the receipts per passenger were slightly decreased. It is noteworthy that 232,871,360 passengers were carried at ½d. fares as against 93,768,671 at 1d. fares.

Lancaster.—Year's Working.—The borough accountant reports a traffic revenue of £5,696 on the Council's tramways, against £5,533 in the previous year, an increase of £163. The expenditure increased by £435, but £500 has been set aside for depreciation. After paying interest and redemption, the net deficit is £2,012.

Leeds.—Female Labour.—The tramway manager (Mr. J. B. Hamilton) has expressed his complete satisfaction with the women conductors, of whom he has now over 400. The employment of the women has released between 400 and 500 men for military service. The pay, with overtime, reaches 30s. a week.

Manchester.—Wages.—As from June 1st, a war bonus is to be paid to the paviors, &c., in the tramway department. The Tramway and Vehicle Workers' Union has applied on behalf of the traffic staff for an additional war bonus, and the Workers' Union has applied for an advance of wages for certain classes of workmen. Both applications have been refused.

North London Electrification.—On Saturday morning last, a successful trial run was carried out on the recently electrified line between Broad Street and Richmond.

Nottingham.—Year's Working.—The total receipts on the working of the Corporation tramway undertaking for the 12 months ended March 31st last amounted to £195,392, an increase of £16,077 compared with the previous year. Working expenses amounted to £121,266, an increase of £8,682, leaving a balance of £74,125, an increase of £7,394, carried to net revenue account. After providing for interest on loans, contribution to sinking fund, &c., the balance is to be divided, £20,350 going in aid of the rates, and £13,150 to reserve and renewals fund. During the 12 months the cars ran 3,885,322 miles, an increase of 95,465 miles over the previous year, and carried 45,741,208 passengers, an increase of 4,530,246. Since the commencement of the war 228 men have joined the Colours, and 62 left the service for munition work or other employment. There are upwards of 100 women conductors in the service, and the majority are carrying out their duties in a quite satisfactory manner. The difficulty of finding drivers has become serious, as men are leaving faster than they can be replaced. Further, the reserve of conductors suitable for training for drivers is exhausted, and very few applications for employment are being received.

Sunderland.—Year's Working.—The total receipts of the Corporation tramways for the last year amounted to £79,124; traffic expenses amounted to £20,915, and the balance carried to net revenue was £34,669. From this amount, interest and sinking fund charges were paid, £5,000 was placed to rate relief, £9,784 to renewals, and other expenditure was met. The passengers carried numbered 19,908,911 as against 18,619,364 in 1915.—*Northern Press Agency.*

Swansea.—Tramway Power-Plant Purchase.—At the last meeting of the B.C., it was reported in connection with the negotiations to take over the Tramway Co.'s power station, that the company had now acquired the freehold, which would be transferred to the Corporation instead of the leasehold interest. Under the agreement, the Corporation has undertaken to purchase the plant and machinery for £10,000, payment to be spread over 26 years at £400 per annum.

TELEGRAPH and TELEPHONE NOTES.

A Wireless Record.—It is reported that the American steamer *Ventura*, which has just arrived at Sydney from San Francisco, states that she picked up wireless messages from the station at Tuckerton, New Jersey, when she was 9,000 miles distant from that place. This is claimed to be a world's record.

Ashton-under-Lyne.—The substitution of junction for trunk circuits between Manchester and adjoining towns has been extended to Ashton-under-Lyne, with which are associated Mossley, Mottram, and Hyde.

Norway.—The Western Electric Co., Ltd., has received from the telegraph department a contract for nine automatic telephone exchanges for Christiania, having a total capacity of 30,000 lines and 35,000 subscribers' stations. The work will occupy a period of six years.

Russia.—Some time ago the Pan-Russian District Councils' League organised a telephone factory in Moscow on a small scale. As such apparatus, and most of the parts thereof, had previously been imported, the first efforts to make a complete telephone apparatus without importations met with serious mechanical difficulties. However, under pressure of the absolute necessity of having such apparatus, by the application of all available technical skill the difficulties were overcome, and solid progress has been made. The factory now employs over 200 hands, and the total production is over 50 apparatus per day.

Trans-Atlantic Telegraphy.—During the Irish rebellion many of the Atlantic cables landing on the West Coast of Ireland were for some days deprived of their land-line connections with the cables connecting Ireland with England, and were thrown idle, while the cables having direct submarine connection with England had to deal with an enormously increased traffic.—*T. and T. Age.*

The German Post Office has made arrangements to permit Swedish telegrams to be transmitted to the United States by German wireless telegraphy, subject to certain conditions.

United States.—The naval administration of the U.S. Government proposes to erect three large wireless stations, one at San Diego, California, one at Cavite in the Philippine Islands, and the third at Pearl Harbour, Hawaii. The last two will have a range of about 9,000 km., which is the distance from San Francisco to Paris. The contract has been placed with an American company. The new stations will enable the United States to communicate with Japan by wireless telegraphy.—*Journal Télégraphique.*

Wireless Telephony.—From May 6th to 8th wireless telephony was employed to transmit orders between the U.S.A. Government at Washington and the U.S. battleship *New Hampshire*, in Hampton Roads; the telephone was also used for communication with naval stations at New York, San Diego (Cal.), Pensacola (Fla.), and other places. During the test the *New Hampshire* was ordered to sea, and returned to her station, reporting by wireless telephone at every hour. The demonstration was successful in every respect.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Ashton-under-Lyne.—June 14th. Engine slack, for the Electricity Committee. Particulars from Borough Electrical Engineer, Wellington Road. Tenders to Mr. J. Neal, Borough Comptroller.

Australia.—Perth.—July 19th. P.M.G. Supply of insulators (Schedule 510). See "Official Notices" to-day.

August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" to-day.

Melbourne.—July 26th. Victorian Railways Commissioners. 400 signal lighting transformers.*

Sydney.—August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.

Brisbane.—July 31st. P.M.G. Power board and accumulators. Schedule No. 381.

Halifax.—June 17th. Steelwork over the dam at the electricity works. Mr. James Lord, Borough Engineer, Town Hall, Halifax. Deposit £1 (returnable).

Keighley.—June 10th. Fitting up the Keighley and Bingley War Hospital, Morton Banks, with electricity. Messrs. Moore & Crabtree, Architects, Keighley.

London.—St. Pancras.—June 13th. B.C. Twelve months' supply of steam coal for the Electricity Department Borough Electrical Engineer.

L.C.C.—June 19th. Asylums and Mental Deficiency Committee. Electric lamps for three months. Mr. H. F. Keene, Clerk, 2, Savoy Hill, Victoria Embankment, W.C.

New Zealand.—PAHIATUA.—July 10th. Borough Council. Overhead wires, poles, street lamps, gas engines, producers, dynamos, auxiliary apparatus and accumulators. Specifications from Borough Offices or Mr. E. J. Fenn, Consulting Engineer, Auckland.*

INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant and switchgear. Specifications from the Tramway Office.

Spain.—June 22nd. Municipal authorities of Sancti Spiritus (Province of Salamanca). Concession for the electric lighting of the town during an undetermined period.

June 28th. Municipal authorities of Infantes (Province of Ciudad Real). Concession for the electric lighting of the town during a period of five years.

The municipal authorities of Puebla del Maestra (Province of Badajoz) have lately invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Stoke-on-Trent.—Coal and slack for the Corporation electricity works for a year. Chief Electrical Engineer, St. Peter's Chambers.

Torquay.—June 19th. Corporation. 5,500 tons of coal for use with mechanical stokers for the Electric Lighting Commitee. Mr. F. S. Hex, Town Clerk.

West Ham.—June 22nd. B. of G. Electrical fittings for three months. Mr. T. Smith, Union Offices, Union Road, Leytonstone, N.E.

Wolverhampton.—June 16th. Electricity Department. Coal and ash-handling plant. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Bury.—T.C. Washed slack, for the electricity works: Pemberton Colliery Co., Ltd.

Dewsbury.—Electricity and Tramways Committee. 2,000 tons of coal, for the electricity works: Crawshaw and Warburton, Ltd.

Installation Contracts.—The following contracts were placed with Messrs. H. J. Cash & Co., Ltd., during May:—

Admiralty.—Electric lighting installation, Chatham.
War Office.—Provision of L.T. cables and distributors, and electric light installation, Dover. Special fittings for operating theatres.
Post Office.—Electric power circuits and mains, telegraph factory, Birmingham.
L.C.C.—Electric light installation, Southampton Street School, Camberwell; ditto, Haverstock Hill School, London, N.W. (See list of tenders below.)

Keighley.—The Keighley and Bingley Joint Hospital Board. Accepted tender: Craven and District Private Telephone and Electric Co., at £216, for the electric lighting of the permanent hospital buildings and the sanatorium.

Leyton.—The District Council is entering into a year's contracts with the Electrical Apparatus Co., Ltd., the Reason Manufacturing Co., Ltd., and Messrs. Chamberlain & Hookham for ordinary electricity meters; also with the B.I. & Helsby Cables, Ltd., for slot meters. The British Thomson-Houston Co. wrote stating that under present conditions they were unable to enter into a contract, as their meter factory was otherwise engaged.

Llanfyllin.—T.C. Accepted tender for the lighting of the streets by electricity for one year, subject to renewal: Mr. R. A. Jones.

London.—London Education Committee. Tenders for installing electric light in the undermentioned schools:—

SOUTHAMPTON STREET, CAMBERWELL.

H. J. Cash & Co., Ltd.	(accepted)	£446
Alpha Manufacturing Co.		491
Foote & Milne, Ltd.		504
Lund Bros. & Co.		506
Alex. Hawkins & Sons		525

HAVERSTOCK HILL, ST. PANCRAS.

H. J. Cash & Co., Ltd.	(accepted)	£301
W. C. Tackley & Co., Ltd.		305
Tredegars, Ltd.		312
Foote & Milne, Ltd.		378
Pinching & Walton		410

The Committee will open and accept tenders received during the Whitsuntide recess for installing electric light in the County Secondary School, Forest Hill.

HAMMERSMITH.—Tenders received by the B.C. for panels required for new switchboards at Shepherd's Bush sub-station:—

Park Royal Eng. Co. (accepted)	£18	Ferranti, Ltd.	£39
Edison & Swan	19	Johnson & Phillips	30
Switchgear & Cowans	20	Electric Construction Co.	31
Reyrolle & Co.	21	Siemens Bros. & Co.	38
Bertram Thomas	25	General Electric Co.	41

Manchester.—Electricity Committee:—

L.P. pipework and valves.—Aiton & Co., Ltd.
Switchgear.—B.T.H. Co., Ltd.
Two water-tube boilers, drain pipes.—Babcock & Wilcox, Ltd. (Sub-contractors: Economisers, E. Green & Sons, Ltd.; lagging, Newall's Insulation Co., Ltd.)
Cable.—Pirelli-General Cable Works, Ltd.
10,000-KW. turbo-generator, also switchgear.—B.W. Electric & Manufacturing Co., Ltd.
Two motors.—Phœnix Dynamo Mfg. Co., Ltd.

Tramways Committee. Accepted tender:—
Block tin.—Williams, Harvey & Co., Ltd.

Salford.—Electricity Committee. Accepted tenders for materials to March next:—

W. T. Glover & Co., Ltd.—Unarmoured cable, schedule of prices.
Key Engineering Co., Ltd.—Fibre pipes, approx. £100.
Doulton & Co.—Stoneware pipes, troughs, &c., £500.
Albion Clay Co.—Stoneware conduits, £200.

Also accepted:—

United Electric Car Co., Ltd.—Permanent-way wagon body, £159.
British Westinghouse Co., Ltd.—Auxiliary steam turbine, £740.
G. & J. Weir, Ltd.—Two roto-feed pumps, £560.

Tenders have also been accepted for the erection and equipment of a sub-station in Blackfriars Road as follows:—

Wm. Gornall.—Building, also machine foundations, £3,280.
British Westinghouse Co, Ltd.—Three-phase E.H.P. switchboard, £1,203.
Bertram Thomas.—Continuous-current switchboard, £2,215.

Materials required in connection with the Willans & Robinson 5,000-KW. turbo-alternator:—

Stewarts & Lloyds, Ltd.—Steel pipes and separator, £159.
Stanton Ironworks Co., Ltd.—Cast-iron pipes and valves, £772.

The Electricity Committee has approved the proposal of Messrs. J. Gerrard & Sons, Ltd., to sub-let the steelwork portion of the contract for the foundations for a turbo-generator to Messrs. Thomas Prickett & Sons.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, June 9th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Eyesight and the War," by Dr. E. Clarke, F.R.C.S.

Chief Technical Assistants' Association.—Saturday, June 10th. At 3 p.m. At the Tavistock Hotel, Covent Garden, W.C. Discussion on "The Advantages and Disadvantages of Various Types of Mechanical Stokers."

Institution of Electrical Engineers.—Thursday, June 15th. At 5.15 p.m. At the Institution Building, Victoria Embankment. Special meeting of Corporate Members to confirm the resolution to exclude alien enemies from membership.

Chemical Society.—Thursday, June 15th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Physical Society of London.—Friday, June 16th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

NOTES.

Power and Heat for Chemical Plants.—In a letter addressed to *Met. and Chem. Engineering*, attention is drawn to the great economy that can be effected by using exhaust steam for heating purposes. The writer says:—

"If it be assumed that 25 per cent. of the heat units of the coal is required in the development of electric energy in an electro-chemical plant employing steam, *then that plant should be developed for utilising the remainder of the available heat units of the fuel* (chiefly in the form of the latent heat of the steam) in multiple-stage evaporating, &c. By so doing the electric energy required for the electrochemical work would be largely a by-product. There are many purely chemical operations where a large preponderance of heat over power is necessary.

"It is conceivable that great plants where heat (at low temperatures) is king, might well put in electric generators and thus obtain electric energy at very low cost. There are great industries in practically all manufacturing communities, where the two great forms of energy, heat and electricity, might mutually complement each other. As the situation now stands, we have great central lighting and power stations wasting 75 per cent. of the heat units of the coal in condensing the steam; and, on the other hand, we have vast sugar refineries and other industries whose chief need is steam-heat. From a heat standpoint they should operate in combination."

If this course were followed, not only could steam compete with water-power, but it might even be found to possess an advantage over the latter.

Clyde Valley Workers.—Mr. James Macdonald, Edinburgh, arbitrator under the Munitions of War Act, has rejected the claims of the labourers employed by the Clyde Valley Electrical Power Co. for increased wages, time-and-half overtime rates, and double pay for Sunday work.

Cobalt for Thermocouples.—In a paper read before the American Electrochemical Society, Prof. O. L. Kowalke advocated the use of cobalt in thermocouples, stating that it was strong and gave a high E.M.F., did not grow brittle like nickel, and could be obtained in a fairly pure state. The combination of cobalt and constantan gave a particularly satisfactory couple. Unfortunately, at present the metal is costly.

Safety Lamps.—The Home Secretary has approved the following safety lamps for coal mines:—

Best's "Excelsior" Lamp, No. 3.
Best's "Gauzeless" Lamps, No. 1 and No. 1A.
"Prestwich Patent Protector 08" Lamp.
Rothwell and Co.'s "A3," "B3," "C3," "D3," and "E3" Lamps.
Teale's Musselor or Thornburry No. 6 and No. 6A Lamps.
Teale's No. 1 Miners' Electric Safety Lamp.

Foreign Trade.—The May Figures.—The following are the electrical and machinery figures given in the official returns for May :—

	Month of May.	*Inc. or dec.*	*Inc. or dec. to date compared with 1915.*
Imports.			
Electrical goods and apparatus, excluding machinery and uninsulated wire... ...	£186,489	+ £98,901	+ £294,569
Machinery	886,846	+ 84,957	+ 70,969
Exports.			
Electrical goods and apparatus, excluding machinery and uninsulated wire	381,161	+ 147,591	+ 367,977
Machinery	1,920,850	+ 90,550	− 310,417

Terrestrial Magnetism.—The report of the Astronomer Royal for the past year states that the magnetic declination is decreasing at the rate of nearly 10 minutes of arc per annum, the declination at Greenwich Observatory being now less than 15°. The magnetic dip, having passed through a minimum, is slowly increasing, and the horizontal force, after remaining at a maximum for some years, has been decreasing since 1912.

Danish Peat Fuel.—Electrical enterprise falls within the scope of the operations which the Danish Tekniske Forening have set themselves, and in 1903 that society instituted a prize of 1,000 kr. for a competitive essay for "the best means of utilising peat as a source of energy for electricity works," the object being to turn to advantage the extensive peat moors existing in Denmark. Various essays have since, at times, been submitted, showing the feasibility of utilising the gas extracted from peat for driving large electricity works. This year the society again invites essays on the best means of recovering and employing the gas for heating and driving purposes, as also the nitric acid and ammonia obtained for other uses.—*Dan Tekniske Forenings Tidsskrift.*

Patents, Designs, and Trade Marks.—The report of the Comptroller-General of Patents, Designs, and Trade Marks for 1915 states that during the year 154 applications for the avoidance or suspension of patent rights were made; licences were granted in 117 cases, 1 patent was suspended, 4 licences were avoided, 6 applications were refused, and 7 abandoned. The number of applications filed for patents was 18,191, compared with 24,820 in 1914 and 30,077 in 1913; the number of patents sealed was 11,457, compared with 15,036 and 16,599 in the two preceding years. The receipts from fees were £275,087, a decrease of £36,191, and the surplus of receipts over expenditure was £94,298, as compared with £128,062 in 1914. Renewal fees amounted to £183,929, a decrease of £1,145, and the sealing fees to £12,837, a decrease of £1,844. The number of applications for the restoration of lapsed patents was 26; 18 were granted, and others are pending. Only three patents are in force which have been prolonged beyond the normal period of 14 years.

Electric Smelting in Newfoundland.—The Hydro-Electric Smelting Co., Ltd., has recently installed an electric copper smelter at St. Johns, Newfoundland. Tests have been made on ore from the Little Bay copper mines, with satisfactory results.

Volunteer Notes.—1st London Engineer Volunteers.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, June 12th.—Technical for Platoon No. 9, 46 Regency Street, S.W.; Squad and Platoon Drill, Platoon No. 10; Signalling Class and Recruits.

Tuesday, June 13th.—School of Arms, 6 to 7; Recruits, 7.15 to 8.15.

Wednesday, June 14th.—Platoon Drill, No. 2 Platoon.

Thursday, June 15th.—Platoon Drill, No. 6 Platoon; Shooting for No. 9 Platoon; Miniature Range; Recruits, 5.45 to 7.45; Instructional Class, 5.45.

Friday, June 16th.—Technical for No. 10 Platoon, 46, Regency Street, S.W.; Squad and Platoon Drill, No. 9 Platoon.

Saturday, June 17th.—Probable date of Inspection by Lord French. Special orders will be issued.

Sunday, June 18th.—Entrenching duties: Parade, Victoria Station (S.E. & C. Railway Booking Office), 8.35 a.m.

Macleod Yearsley, *Adjutant.*

3rd Batt. (Old Boys) Central London Volunteer Regiment.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, June 8th, 1916 :—

Week-End Parades.—Saturday.—The Battalion will Parade outside Baker Street Station at 2.30 p.m., and proceed by train to Wembley Park for Drill under the Commandant.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties.

G. H. F. Duncan, *Acting Adjutant*, O.B.C., *Platoon Commander.*

Technical College for Middlesbrough.—The *Times* states that Mr. Joseph Constantine, a Middlesbrough shipowner, has given £40,000 towards a scheme for the establishment of a technical college in the town, and other local firms have promised £15,000.

Institution Notes.—National Electric Light Association, U.S.A.—At the end of last month the annual convention of the "N.E.L.A." was held at Chicago. The Association was formed in 1885, and now has a membership of over 14,700, representing, according to the *Electrical World*, nine-tenths of the electricity supply industry of the United States, which possesses an aggregate capitalisation of 600 millions sterling and an annual revenue of 90 millions.

Institution of Electrical Engineers.—On Thursday next, June 15th, at 5.15 p.m., a special meeting of Corporate Members will be held to confirm the resolution which was passed on May 25th to exclude alien enemies from membership. It is to be hoped that members will not regard this as a mere formality, and fail to attend in sufficient numbers to ratify the resolution; it is important that they should not now slacken their efforts, but be present in force to complete the work to which they have set their hands.

Inquiries.—Makers of electrical condensers of large capacity, and machinery for manufacturing small pocket batteries for flash-lights, are asked for.

Appointment Vacant.—Engineer for telephone system in India. See our advertising pages to-day.

The Organisation of British Engineering Industry.—The following resolutions were unanimously carried at a general meeting of the Council for the Organisation of British Engineering Industry (Manufacturing Engineering Concerns Section), held in Manchester on Tuesday last :—

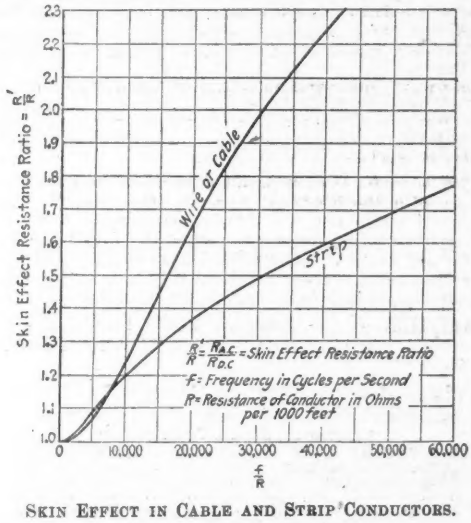
"1. That this meeting approves the steps taken to organise British Engineering Industry by the Council appointed on December 6th, 1915.

"2. That this meeting approves the formation of an Association on the lines advocated in the memorandum circulated, with power to negotiate, and if advisable to amalgamate or combine with existing or projected Associations; and this meeting pledges itself to support such an Organisation.

"3. That those firms who by signing the card have promised their adhesion and support to the Organisation be asked to subscribe to the funds of the new Association, and to make forthwith a minimum payment of £5 on account of their first year's subscription towards preliminary expenses.

"4. That the existing Committee be empowered to give effect to the resolutions passed at this meeting."

Skin Effect in Strip Conductors.—In the *Electrical World*, Mr. H. B. Dwight has given a practical way to calculate the skin effect in strip conductors—that is, the ratio of the alternating-current resistance to the direct-current resistance.



Skin Effect in Cable and Strip Conductors.

The curve shown in the figure, which is self-explanatory, applies to strip of copper, aluminium or other non-magnetic conductor. The strip should not be close to the return conductor; that is, there should be an air space between the strip and the return conductor somewhat greater than the width of the strip. The thickness of the strip should not be more than about one-tenth the width, otherwise the value of skin effect will lie intermediate between the curves for strip and wire. The curve applies to a single strip, and not to the case where two or more strips are close together and connected in parallel, as in ventilated bus-bars. The curve is applicable for any temperature, since the value of the resistance R is to be taken for the temperature required.

Resistance Alloys.—Messrs. F. M. Sebast and G. L. Gray read a paper at a recent meeting of the American Electrochemical Society on alloys of nickel and chromium with copper and manganese. They stated that an alloy of 15 Cu, 85 Ni, 20 Cr, had a very high resistivity (112 microhms per cm.^{3}), and a negligible temperature coefficient (0·000078). An alloy containing approximately 55 Cu, 45 Ni, 15 Mn had a resistivity of 70 microhms per cm.^{3}, and a zero temperature coefficient at 20° C. This they considered a better resistance alloy than any at present used for precision apparatus.

Russian Copper Production in 1915.—According to a statement issued by the Military Industrial Committee, the total production of copper in Russia in the year 1915 amounted to 1,587,155 poods, against 1,949,721 poods in 1914 and 2,095,289 poods in 1913. The production per district in the last three years was as follows, in poods:—

	1913.	1914.	1915.
Urals	1,055,122	1,025,057	1,043,892
Caucasus	610,661	495,387	233,559
Siberia...	345,273	342,881	259,423
Chemical and refining works	84,233	86,396	50,281
	2,095,289	1,949,721	1,587,155

Embargo on the "E.T.Z."—It is reported in *l'Industrie Electrique*, on the authority of the Swiss *Elektroindustrie*, that the German Government has forbidden the transmission abroad of the *Elektrotechnische Zeitschrift*, the official organ of the German Elektrotechnischer Verein and the Verband Deutscher Elektrotechniker. The *E.T.Z.* has never busied itself with war affairs, but our contemporary suggests that the interdict is due to the desire of the Government to conceal from foreign eyes the scarcity of certain materials such as copper and aluminium, which is revealed by the publication of official regulations for the use of zinc and iron as electrical conductors. If so, it comes too late.

The Metric System.—On April 1st, 1916, the old systems of weights and measures in use in Denmark were abolished and the metric system came into force.

Germans and Austrians Suing in the Courts.—In the City of London Court, on June 6th, A. T. Speedometer, Ltd., assignee of George Zimmermann, of London, E.C., sued Stanley & Co., of Southend, for £10 for goods supplied. Defendants objected to pay because plaintiffs were Germans. Mr. H. Snowman, plaintiffs' solicitor, said that Zimmermann was a German, and he was interned. While he was an alien enemy he did not come within the scope of the Defence of the Realm Act. A man named Max Niechy, who said he was an Austrian who was exempt from internment (although he was not naturalised), having lived in England for 10 years, was called to prove the assignment. The plaintiff company, he said, was now in liquidation, and was under the control of the Board of Trade. The majority of the shareholders were Austrians and Germans. Some of them were in England and some in Germany. Judge Atherley-Jones, K.C., said he must find for the plaintiffs with some reluctance, having regard to the last decision of the Court of Appeal, as that was the law until the House of Lords gave its long-deferred judgment. In his humble view, the opinion of the Court of Appeal enabling such companies to sue was not the law of the country. Therefore, as the company was registered in England, it was entitled to recover, notwithstanding the fact that the beneficiaries were alien enemy shareholders resident, or carrying on business, in enemy territory. But the money would be kept in Court until after the war was over. That was a security against the money leaving the country.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. P. Priestley, the engineer and manager of the Mexborough and Swinton Tramways Co., who is about to leave to take up the management of the Oldham Corporation tramways department, was the recipient of a presentation and good wishes at the Tramways Institute, Rawmarsh. The presentation took the form of a silver tea service.

Mr. G. H. Browne, A.M.I.E.E., acting engineer and manager of the Borough of Ilkeston tramways and electricity department, has been appointed manager and engineer of the Mexborough and Swinton Tramways Co., at £400 per year, succeeding Mr. P. Priestley.

Mr. W. G. Stock has been appointed chief engineer at the Hindhead (Surrey) electricity works.

On May 4th one of the employés at the Fulham electricity works (J. Fish) was struck by the crane on the Quay Wall at the Townmead Wharf, and knocked insensible into the river at high tide. Shift engineer T. H. Welch promptly jumped in and saved him. The Electricity Committee has very fittingly passed a resolution congratulating Mr. Welch upon his courage and skill, and recommending him for the Royal Humane Society's Medal or Certificate.

The original list of 42 candidates for the position of tramways manager at Belfast has been reduced to six. The question of the appointment has been referred to a sub-committee of the Tramways and Electricity Committee for consideration and report.

General.—Mr. J. Arthur Sykes, M.I.E.E., assistant to general manager of Messrs. Wm. Beardmore & Co., Ltd., Glasgow, has resigned this appointment in order to take up that of works manager to the Yorkshire Copper Works, Ltd., Leeds.

In the list of aliens to whom certificates of naturalisation were granted during May, the following entries appear:—

J. Prosper Dethier (known as John Prosper), Belgium, electrician, residing at Palmers Green, Middlesex.

F. C. C. Nielsen, Denmark, retired manager of a telegraph company, residing at Westminster.

Coun. James Heald, head of the firm of Messrs. Calvert and Heald, electrical engineers, Lancaster, and chairman of the Lancaster Electricity Committee, has been elected Alderman of the Borough, of which he was Mayor in 1904-5.

Prof. Dobson, general manager of the Johannesburg municipal gas, electric, and tramway departments, has been appointed Major in command of two Pioneer Corps for service in East Africa. Each Corps is to consist of 120 men, and is intended to be formed of men skilled in the use of explosives.

Mr. J. M. Gray, assistant engineer and electrician at the Maypole Margarine Works, Southall, has retired after 22 years' service. He was presented with a gold watch by the directors, a canteen of plate by the heads of departments, and a marble clock by the engineering staff. The Maypole Co. produces its own power, the average output being over 1,500,000 units per annum, the installation comprising over 100 motors.

Mr. G. S. Herschell and Mr. T. Birkett, who have both been 42 years in the service, has been appointed to succeed Messrs. H. M. Knight and T. Warden (retired), as superintendents in the telegraph department of the Edinburgh Post Office.

London Gazette notice:—Territorial Force, Royal Engineers. *Tyne Electrical Engineers*: Staff-Sergeant Addison Stanley Burdis to be Second-Lieutenant (on probation).

Mr. C. le Maistre, secretary of the International Electrotechnical Commission, arrived in New York on May 12th on a mission to the electrical engineering societies of the United States and Canada with regard to the adoption of international standards for electrical machinery, &c.

Birthday Honours.—In the list of King's Birthday Honours are the following, to whom we tender our congratulations:—

Knighthoods are conferred upon: George T. Beilby, Esq., F.R.S., the well-known chemist; E. C. Geddes, Esq., Deputy-Director-General of Munitions, and formerly of the North-Eastern Railway.

Appointed C.B.'s:—Capt. M. H. P. Riall Sankey, late R.E.; the Hon. Arthur Stanley, M.V.O., M.P.; George E. Pemberton Murray, Esq., Secretary to the Post Office; W. H. Beveridge, Esq., Assistant Secretary, Board of Trade; U. F. Wintour, Esq., C.M.G., Director of Contracts, War Office.

Roll of Honour.—In the first list of losses of officers in the great battle of the North Sea, May 31st, we find the names of the following:—

Warrant Electrician Lawrence Gatt, *H.M.S. Queen Mary.*

Warrant Telegraphist Ernest Kemp and Warrant Electrician Arthur C. Worthington, *H.M.S. Invincible.*

Warrant Electrician Arthur Beales, *H.M.S. Indefatigable.*

Warrant Telegraphist Henry Arberry, *H.M.S. Defence.*

Acting Warrant Telegraphist Harry Burnell and Warrant Electrician E. G. Goad, other ships.

Mr. John Reginald Hatch, an electrician on the *Queen Mary*, which was lost in the big sea fight last week, was employed at the Southport electricity works prior to his enlistment in the naval service, being apprenticed to Mr. A. Black, the borough electrican engineer.

Private A. McCulloch, of the Loyal North Lancashire Regiment, formerly employed at the Peel-Conner Telephone Works, Salford, has died from wounds received in action.

The death in action of Private Chas. Holdway, Loyal North Lancashires, who, prior to the war, was engaged at the works of Messrs. Dick, Kerr & Co., Ltd., Preston, is reported.

Mr. C. R. Steele, of the Somerset Light Infantry, who has fallen in action in France, was, until the war broke out, engaged at Siemens Bros. Dynamo Works, at Stafford.

Mr. Harwood Maulkinson, of the Royal Naval Reserve, formerly an electrician at Fleetwood, has lost his life through the mining of a trawler in the Mediterranean whilst on patrol work.

The Distinguished Service Cross has been awarded to the following officer in recognition of his services whilst employed on transport duties at the Dardanelles:—

Harold G. E. Wightman, Officer Commanding cable ship *Levant*, who rendered good services in connection with the laying of the cable from Imbros to Suvla on the night of the Suvla landing, and in laying and repairing cables off the peninsula frequently under heavy fire.

The following officers are mentioned for good services whilst employed on transport duties at the Dardanelles:—

Alan Henry Black, Chief Officer, cable ship *Levant.*

Alfred L. Spalding, Chief Electrician, cable ship *Levant.*

Thomas C. Birbeck, Assistant Electrician, cable ship *Levant.*

Alexander S. Henderson, Chief Engineer, cable ship *Levant.*

Arthur Hill, Cable Jointer, cable ship *Levant.*

The Distinguished Service Medal is to be awarded to Wireless Telegraph Operator (First Class) A. Andrews, R.N.R., O.N. 13 W.T.S.

Obituary.—Mr. Leslie S. Robertson.—Amongst the staff of Lord Kitchener on board *H.M.S. Hampshire* was Mr. L. S. Robertson, whose death will be lamented by the engineering world, and is to ourselves a personal loss. Mr. Robertson was best known as the Secretary of the Engineering Standards Committee, a position which he filled with the greatest ability from the formation of the Committee in 1901 to the time of his death; in July, 1915, he received an appointment at the Ministry of Munitions as Assistant to the Director of Production, in which capacity he was accompanying Lord Kitchener to Russia. He was the youngest son of Sir W. R. Robinson, sometime Governor of the Presidency of Madras (the family name "Robertson," its original form, having been resumed in 1898), and entered engineering life at the works of Messrs. Denny Bros., Dumbarton; he afterwards joined Messrs. John I. Thornycroft & Co., of Chiswick. He was the author of a standard work on steam boilers, and a member of the firm of Robertson & Outram, consulting engineers; he also took an active part in the management of engineering concerns, being a director of a large number of companies, and chairman of two of them. His loss will be long and widely felt, not only in the engineering world, but also in social circles, for he was a most genial and warm-hearted companion, and of a kindly disposition.

Mr. D. T. Miles.—The death occurred on Monday of Mr. D. T. Miles, mains engineer, Bath Corporation electricity works. He was taken unwell with tonsilitis on Saturday morning. He had for 15 years held the position of mains engineer at Bath, and had been solely responsible to Mr. Francis Teague, the electrical engineer, for the whole of the outside work. He assisted to lay the original cables in Bath in 1889, when he was a foreman for Callender's Company, the contractors. Mr. Miles's death is deeply regretted, for he was one of the best known men in Bath. He leaves a widow and four children.

NEW COMPANIES REGISTERED.

Mander & Co., Ltd. (143,989).—This company was registered on May 31st, with a capital of £2,000 in £1 shares, to take over, as from April 1st, 1916, the business of electrical and mechanical engineers now carried on at 125, Hockley Hill, Birmingham, and to adopt an agreement with A. F. Mander. The subscribers (with one share each) are: A. F. Mander, 38, Davy Road, Handsworth, electrical engineer; J. E. Bendall, 20, Greenhill Road, Moseley, baker and confectioner. Private company. The first directors are A. F. Mander and J. E. Bendall (both permanent). Solicitor: E. H. Clutterbuck, Minories Chambers, Birmingham. Registered office: 125, Hockley Hill, Birmingham.

Galloway Engineering Co., Ltd. (9,604).—This company was registered, in Edinburgh, on May 26th, with a capital of £40,000 in £1 shares, to carry on the business of engineers, electricians, chemists, &c. The subscribers (with one share each) are: D. L. Forrest, 116, Hope Street, Glasgow; C. Finlayson, 160, West George Street, Glasgow. Private company. The number of directors is not to be less than two or more than seven; the first are Major H. R. Alexander and R. H. Ballantine. Qualification, £100. Registered office: Shakespeare Street, Dumfries.

Telephone Motor Works, Ltd. (143,934).—This company was registered on May 25th, with a capital of £1,000 in £1 shares, to take over the business of motor engineers, makers and repairers, &c., carried on as the Telephone Motor Works at 15b, Allsop Place, Baker Street, W., and elsewhere. The subscribers are: A. J. Watt, 15b, Allsop Place, Baker Street, W., engineer, 200 shares; C. W. G. Green, 28, Rectory Road, Stoke Newington, N., law clerk, 350 shares. Private company. The number of directors is not to be less than two or more than five; the first are A. J. Watt (managing director), and C. W. G. Green. Solicitor: A. Sargeant, 207, Union Court, Old Broad Street, E.C. Registered office: 15b, Allsop Place, Baker Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

C. A. Vandervell & Co., Ltd.—Particulars of £100,000 debentures, created by resolutions of March 24th and May 18th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold and leasehold properties. No trustees.

Baxendale Bros., Ltd.—Particulars of £2,000 debentures, created May 11th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Pritchett & Gold and Electrical Power Storage Co., Ltd.—Deposit on May 12th, 1916, of deeds of a mortgage on land and buildings at Highfield, Feltham, Mdx., to secure all moneys due or to become due from company to Barclay & Co., Ltd., 95, Victoria Street, S.W., stamped to cover £3,000 registered. A memorandum of satisfaction in full on May 11th, 1916, of charge dated July 29th, 1915, securing all moneys due or to become due from company to Barclay & Co., Ltd., has also been notified.

Berkeley & Young, Ltd. (formerly Bergtheil & Young, Ltd.) (95,405).—Return dated September 21st, 1915 (filed April 20th, 1916). Capital, £12,000, in £1 shares. 10,010 shares taken up. £7 paid. £10,003 considered as paid. Mortgages and charges: Nil.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—Capital, £200,000, in £1 shares (99,990 preference and 100,010 ordinary). Return dated March 29th, 1916. All shares taken up. £1 per share called up on 50,010 ordinary, 8s. per share on 50,000 ordinary, and £1 per share on 99,990 preference. £170,000 paid. £30,000 (12s. per share) considered as paid on 50,000 ordinary. Mortgages and charges: £50,000.

Electro Galvanizers, Ltd.—Particulars of £4,000 debentures, created May 9th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Lancashire Dynamo and Motor Co., Ltd.

After providing for debenture and bank interest, and charging extra depreciation on machinery and plant on account of war wastage, the profit for the year ended December 31st, 1915, was £31,534, plus £1,118 brought forward. The dividend on the preference shares, 5½ per cent., is paid, and interim and final dividends and bonus on the ordinary shares total 12½ per cent. for the year, free of tax, as against 8 per cent., free of tax, for the previous year. Directors' fees require £1,400, £14,992 is put to reserve (making it £42,000), and £1,450 is to be carried forward. The profit as shown for the past year is considerably greater than the pre-war average years (1912 and 1913), but this is almost entirely caused by additional output, partly at Trafford Park works, but mainly at a specially equipped new works for war service. The total number of persons employed in 1915 was double the average of the two pre-war standard years. The current year's orders on hand are very large, and might be still further increased if they could be executed, but the shortage of men continues. Women in considerable numbers have been engaged and successfully trained for working the smaller machines installed in the new works. The annual meeting was held on Monday last.

German Electrical Companies.

The Hoch Frequenz Maschinen A.G., of Berlin (Goldschmidt machines for wireless telegraphy) has been absolved from submitting accounts for the past year.

The Kabelwerk Duisburg, of Duisburg, recommends the payment of a dividend of 18 per cent. for 1915, as in the previous year, together with a bonus of 12 per cent.

The accounts of the *Kabelwerk Wilhelminenhof, of Berlin*, which belongs to the Carlswerk group, show net profits amounting to £12,200 for 1915, as compared with £10,500 in the previous year on an ordinary share capital of £50,000.

The Ver. Isolatoren Werke, of Berlin-Pankow, report that the company's activity in peace manufactures (insulators, &c.) further diminished in 1915, although extensions of buildings and machinery were necessary for the execution of Army orders. No dividend was paid for the previous year, and the net profits of £600 earned in 1915 also do not permit of any distribution on the ordinary capital of £50,000.

The accounts of *Felten & Guilleaume, Carlswerk, of Cologne-Mulheim*, for 1915 indicate net profits, after appropriating £149,000 for depreciation, as against £111,000 in 1914, amounting to £353,000, as compared with £300,000 in the previous year. A dividend of 11 per cent. is in contemplation, as compared with 8 per cent. in 1914. It is proposed to increase the share capital to £3,000,000 by the issue of new shares for £250,000.

The report of the *C. Lorenz A.G.* (*Telephone and Telegraph Works*), *of Berlin-Schoneberg*, states that the turnover in 1915 experienced a considerable increase, and most of the business was for war contracts. The orders referred almost exclusively to articles of bulk production, and special plant had to be obtained for their manufacture. Including the balance from 1914, the accounts show net profits amounting to £83,000, as compared with £50,000 in the preceding year, and a dividend of 34 per cent. is proposed, as against 32½ per cent. in 1914. It is now intended to increase the share capital to £225,000 by the issue of new shares for £75,000, at the price of 175 per cent.

The Deutsch-Ueberseeische Elektrizitats Gesellschaft, of Berlin, which owns large supply works at Buenos Aires and other towns in South America, reports gross receipts amounting to £1,520,000 for 1915, against £1,495,000 in the previous year. After defraying general expenses, interest charges, &c., there remain gross profits of £1,118,000, as against £1,105,000, of which depreciation and reserve funds have absorbed £371,000 and £353,000 in the two years respectively. The directors recommend the payment of 6 per cent. on the preference capital, as compared with 5 per cent. in 1914, and 10 per cent. on the ordinary shares, as in the preceding year.

The report of *Hartmann & Braun A.G., of Frankfort-on-Main*, states that the production of munitions, which began at the end of 1914, was brought into full operation in 1915, and new electrical measuring instruments were also required for the defence of the country. Thanks to the large stocks of measuring apparatus, the company was able to supply customers in neutral countries in so far as legal regulations did not impose an embargo. After allocating £26,000 to depreciation, as compared with £12,000 in 1914, the accounts exhibit net profits of £38,000, as against £15,000, and the dividend proposed is at the rate of 12 per cent., this contrasting with 8 per cent. for 1914.

The directors of the *Akkumulatoren Fabrik A.G., of Berlin-Hagen*, report that the works were well employed in 1915, and the turnover of the German and Austrian works rose from £1,011,000 in 1914 to £1,229,000 last year. Increases in sale prices were made to equalise the dearness of raw materials and higher wages, so as to earn the profits used in peace times. It was impossible to give any information regarding the company's foreign undertakings, as communications, even with neutral countries, were difficult. The net profits total £138,000, as compared with £148,000, but as no special war provident grant is provided for, as against £26,000 set aside

for this purpose in 1914, the dividend is at the rate of 20 per cent., as compared with 18 per cent. in the preceding year.

The report of the *Deutsch Sudamerikanische Telegraphen Gesellschaft, of Cologne,* states that the cable between Monrovia and Pernambuco was still in operation during the first eight months of 1915. On September 13th, however, the cable was severed, and since that date the company's network has been at a standstill. The Compania Telegrafico-Telefonica del Plata, of Buenos Aires, in which the company is interested to the extent of £106,000, again concluded its year's working with a slight loss, and the Cologne company consequently transferred £15,000 from the disposition fund, so as to provide a reserve for this investment. The net profits are returned at £41,000, as compared with £59,000 in 1914, and a dividend of 6 per cent. is proposed, being the same rate as in the previous year.

The report of the *Deutsch-Atlantische Telegraphen Ges., of Cologne,* states that it could not be foreseen when the repair of the company's interrupted cables and the resumption of working could take place. The news from the Vigo station was good, and the information from Horta to the end of March, 1916, was also favourable. The gross profits declined by £62,000 in 1915, as compared with the previous year. After meeting general expenses, the accounts indicate a loss of £43,000, which is reduced to £26,000 through the balance brought forward from 1914. By the appropriation of £100,000 from the special reserve fund, it is possible to extinguish the deficit and pay a dividend of 6 per cent. on the ordinary share capital of £1,200,000, as compared with 6½ per cent. in 1914, and 7½ per cent. in each of the four preceding years.

The report of the *Bergmann Elektrizitats Werke* for 1915 states that while the departments reserved for peace manufactures had to work at a restricted output owing to the State seizure of various raw materials, those devoted to the production of war materials had to work with continuous day and night shifts. A considerable increase in the turnover took place as compared with the preceding year, and the sale prices were adjusted to the dearer raw materials and higher wages. The greater total profits were not only due to the execution of war contracts, but also to the sale at good prices of stocks which were previously entered at a low valuation. In order to render the undertaking independent as far as possible in the provision of raw materials, the company had embarked upon the working up of metals in substitution for those which were requisitioned by the Government. The dividend, as previously reported, is at the rate of 10 per cent., as against 5 per cent.

Indo-European Telegraph Co., Ltd.

The adjourned general meeting was held on May 30th, Mr. J. H. TRITTON presiding. The position of the company, he said, had remained unchanged during the year. Their communications through Germany had remained severed. The South Russian and Persian lines had done good service, the staff everywhere having remained at their posts. The Odessa-Constantinople cable, in which they had a joint interest, had been closed down since Turkey entered the war. There was no prospect of resumption of the company's main route, and it was the wish of the British Government and the cable companies with whom they had working arrangements that they should await the termination of hostilities before committing themselves to any definite decision for the re-establishment of the through service to India *via* Russia, so that the most suitable route should be determined upon. Last year they received an assurance from the British Government that facilities would be given to the company for the re-establishment of the Indo route. The Imperial Russian Government had also promised facilities to the same end, together with an extension of the existing concession. Such extension should render possible the very considerable expenditure on capital account which would be involved in the re-establishment of their route. The revenue for the year showed an important increase, and the expenses a decrease—a satisfactory and unlooked-for state of affairs, which was entirely due to a prolongation of the working arrangements with the other telegraph administrations, except for which a large decrease of receipts would have been recorded. They could not hope for a continuance of such more or less artificial prosperity, and under new arrangements with their friends they considered they were assured of sufficient receipts to provide a dividend of 7 per cent. upon the capital of the company after payment of all expenses, an arrangement which would continue until one year after the war. The company had been very liberally treated by the Indo-European Telegraph Department of the Indian Government and the Eastern and associated companies. It would remain with the directors to augment the dividend thus provided by withdrawal from the fund established for the equalisation of dividends. They might well congratulate themselves that the reserve funds of the company stood as they did. Their endeavours to assist the Government of the country had ranged from the manufacture of gauges of microscopic accuracy, which had more than once received high commendation, to subscriptions to war loans aggregating upwards of £150,000. The levy of the tax-gatherer in respect of excess profits necessitated the putting aside out of surplus £15,000 for last year's excess. In regard to the constantly recurring items of depreciation of investments, the £25,000 set aside in 1914, which some thought excessive, had not proved sufficient, and they had now set aside £35,000 for the same purpose. It was proposed to appropriate £10,000 towards wireless development and research, although last year's vote had not been quite exhausted. They would not be able to do this out of income for 1916. They would eventually have no cause to regret the money expended in this direction. The Indo Co. had a predominant interest in the Galletti Co. For more than eighteen months it had been nothing but a source of expenditure to them, and this in spite of negotiations which at one time appeared likely to offer a solution of what was practically, owing to the war, a deadlock, but which came to nothing. The directors had determined to bring to an end this state of affairs; indeed, they had no option but to do so in view of the material diminution of the earning power of the Indo Co. They proposed, therefore, in the interest of all concerned, and particularly of the Galletti shareholders, before whom there was no other alternative than liquidation, to enter into a new combination of interests with Creed Bille & Co., Ltd., manufacturers of telegraph apparatus of every sort, whose business was in a highly prosperous position. This company would be enlarged by the issue of additional capital, of which the Indo Co. would take up to £30,000 for the development of the wireless side of the business. The patents owned by the Indo Co. and those owned by the Galletti Co. would be transferred to the Creed Bille Co., on whose board the Indo Co. would be represented. The value at which these patents were taken was fixed at £105,000, of which the greater part was applicable to the Galletti Co., to be paid in cash by an annual percentage of the divisible profits of the combined undertakings. Facilities were also given for an option to take up 20,000 £1 shares at par, should the issue be advisable, thus enabling Mr. Galletti or others interested to participate in the future development of their patents. The directors felt that the prospects of the radio-telegraphic and telephonic patents would be enhanced by this arrangement. They hoped that in the interest of the War Office and the Admiralty no difficulty might be found when they made the necessary application to the Treasury Committee for new issues to sanction the scheme. They would regret that anything should retard a step which they considered afforded good prospects of ultimate success and provided an immediately dividend-paying investment.

Anglo-Argentine Tramways Co., Ltd.

MR. J. B. CONCANON presided at the annual meeting on May 25th. He said that there was a net decrease in receipts of £141,380, and a saving in expenses of £94,256. The amount carried to net revenue account was £47,123 less than last year. In view of the outlook for the current year they could not recommend an ordinary dividend. Although the financial position in Argentina was sound, enterprise in Buenos Aires had been almost at a standstill, particularly in the building trade, capitalists and financiers being reluctant to embark in new operations. Confidence seemed to be slowly gaining ground, but he feared that no marked improvement could be looked for during the continuance of the war. The very high cost of freight and limited tonnage hampered both exports and imports, and would have a very detrimental effect on expenditure on cost of energy. Up to April 30th, though the receipts were down by only £32 compared with the corresponding period of 1915, the expenditure was £33,495 more, entirely due to dearer energy, and they would have to face a greater ratio of increase for the remainder of the year. The supply company from whom they got their current assured them that they had already secured sufficient fuel to carry on until the end of the year. Great credit was due to the general manager, Mr. Pedriali, for the substantial economies he had effected, but there was a limit beyond which he could not go, having regard to the efficient working of the system. The sinking fund for the redemption of the 5 per cent. debentures came into operation this year, and would entail a charge on revenue of £8,000. The chairman said he thought it well that he should correct a misapprehension which had got about to the effect that the company was "controlled by Germans." There was no foundation for that rumour. The ordinary shares were all held by the Compagnie Générale de Tramways de Buenos Aires, of Brussels, and the shares of the Brussels Co. were owned by Belgian, French, and Swiss subjects, none being held by Germans.—Mr. G. A. TOUCHE, M.P., who seconded the adoption of the report, said that the position was that the gross takings had gone back to a little below the level of 1912, notwithstanding the opening of the subway. Shipping difficulties would stand in the way for some time to come. While the present condition of things obtained it would be idle to pretend that the outlook for such an enterprise as theirs, depending upon the supply of fuel, was promising. He feared that the position was likely to get worse rather than better.

Great Northern Telegraph Co., Ltd., of Denmark.

At the meeting held at Copenhagen, on May 6th, Consul-General W. WEIMANN said that the company had experienced the same difficulties as had hampered all international intercourse since the beginning of the war, but the strict neutrality observed by the company and the correctness of its service were being rewarded by the continued confidence of its concessionary Governments. Apart from the cables between Denmark and Russia, which, on account of the war, they had been unable to repair since they became interrupted in November, 1914, seven of the company's cables in Europe had suffered 11 interruptions, whilst in the Far East 19 breaks had occurred in nine cables. Considering the dangers to navigation in

the European seas spanned by their cables, it was fortunate that the interruptions during 1915 had been less numerous than in the last few years. In Europe the cable steamer *H. C. Orsted* had been on active service for 140 days, of which 32 were for the account of others, whilst in the Far East the cable steamers *Store Nordiske* and *Pacific* had been occupied for 171 days, for 103 of which they were engaged for account of other parties. The Wladiwostock and Kiachta routes had been in satisfactory working order, but unfortunately the decrease in the traffic transmitted by these lines between Europe and the Far East since the beginning of the war had continued, and had been even more perceptible towards the end of the year. In these circumstances, they had provisionally returned to the Imperial Russian Telegraphs the wire between Petrograd and Irkutsk, which some years ago was placed at the disposal of the company's offices at the two places above-mentioned and was reserved for the transmission of the Far Eastern traffic. The wire was now fully used for the huge internal correspondence of Russia. The automatic instruments lately introduced at their principal offices in Europe had demonstrated their great value during the war; but for these instruments the work would have proved overwhelming for the staff. They had recently commenced to introduce similar instruments in the Far East, where the working conditions differed in several respects from those existing in Europe, and as soon as circumstances permitted these instruments would be employed more generally in the Far East also. They naturally continued to watch the development of wireless telegraphy, but hitherto had had no occasion for occupying themselves actively therewith, apart from the installations on board the cable steamers during later years. A change in this passive attitude might, however, be brought about in the near future, as they were negotiating an arrangement with the Danish Government, by which the company was to undertake the establishment of wireless communication within the Faroe Islands and the working of the stations on behalf of the Government. Circumstances permitting, two stations were to be erected in the course of the current year, one at Thorshavn (Stroemoe) and the other at Tveraa (Suderoe); the former would be open also for communication with ships at sea. The scope of the scheme was purely local, and, as the traffic to be transmitted was insignificant, they did not expect to derive pecuniary benefit from the arrangement. Their main purpose in proposing to saddle themselves with this wireless service was to facilitate the fulfilment of a most natural wish of the Danish Government, viz., to give to the inhabitants of Suderoe the benefit of telegraphic communication with the rest of the world. The International Telegraph Conference which was planned to take place in Paris last year—the 50th since the foundation of the Telegraph Union—had been deferred *sine die*. During the year, and particularly during the first six months, the telegraphic traffic over the company's European cables had been extraordinarily heavy, and, as a consequence, the working zeal of the staff at the majority of the European stations had been tested most severely. The employés had, however, everywhere performed the very strenuous task imposed upon them with goodwill and with unflagging ardour; but now that certain classes of traffic were decreasing owing to circumstances in connection with the war, they might hope to obtain a well-earned respite shortly. The outcome of the present situation was still so obscure that every reason existed for repeating the view emphasised at the last general meeting, viz.: "That this appalling war which has hitherto brought prosperity to the company, may at any moment affect its interests adversely." The speaker proceeded to refer to the accounts, and to say that the board felt that the same dividend and bonus as last year (22 per cent.) might safely be paid.

Eastern Telegraph Co., Ltd.

SIR J. WOLFE BARRY, presiding on May 24th at the annual meeting, said that the result of the year's operations was remarkable. The gross revenue was in excess of any hitherto attained by the company, and amounted in round figures to £2,104,000, an increase of £458,691. The total expenses were about £72,000 more than last year. Included was an amount of £36,642 for special payments to the staff and other expenses in connection with the war. The large sum of £307,037 appeared in expenses for income-tax payable in England and excess profits duty. Notwithstanding these heavy additional taxes and the increased expenses, the final amount available for distribution was £113,895 in excess of 1914. Under these circumstances, they were fully justified in recommending a final dividend of 2½ per cent., making 6 per cent. for the year, as against 5 per cent. which had been paid for many years past, while maintaining the usual bonus of 2 per cent., making a total distribution of 8 per cent. for the year, free of income-tax. The stockholders were asked to approve the proposal that the directors' fees should be paid free of income-tax, as was the case in respect of the stockholders' dividends and bonuses, and was also the case with respect to all salaries of the staff at home and abroad. He had referred at recent meetings to the renewal of some of the older section of cable in the Red Sea, and to new cables which had been laid between Gibraltar and Alexandria and from Aden to Colombo. These operations had entailed a very large expenditure, aggregating nearly £1,400,000, and this sum had been charged against the general reserve fund during a period covering the last five years, the final instalment of £200,000 being included in the present accounts. Although it was difficult under the existing circumstances to obtain a reliable valuation of the reserve fund investments, it had been decided, as a result of the approximate valuation made, to increase the provision for investment fluctuations, and a further sum of £125,000 had been taken from the general reserve fund for that purpose, making a total provision to date of £450,000. This fund had been well maintained, and the balance remaining was £1,805,945, or rather more than it was before the heavy withdrawals on account of the new cables, &c. He believed that at no period in its history had this company stood so well in the eyes of the Government and of the public as to-day. The foresight exercised in laying additional cables to provide in advance a margin of carrying capacity beyond immediate requirements had stood them in good stead. It had enabled them to maintain an efficient system for the Government, and, subject to the conditions which had necessarily been imposed upon commercial correspondence, a continuous and trustworthy service had also been available, notwithstanding the unprecedented volume of traffic. The principal factors which had caused the increase in the number of words carried during the year were the interruption of the Indo-European Telegraph Co.'s line to India, and also that the carrying capacity for commercial work of the Great Northern Telegraph Co.'s route to China and Japan had been greatly reduced on account of Governmental requirements. Although the Government had permitted the use of nine codes, which had to a considerable extent restricted the use of plain-language telegrams, still the amount of work transmitted over the cables had shown a large increase, so that when any of the main cables had become interrupted from one or other of the natural causes, some delay to commercial traffic must necessarily result. So far, however, they had been able to maintain a constant service throughout their system. The chairman proceeded to refer in some detail to the manner in which the company had assisted Government departments, the Colonial, and other Forces by facilitating communication by telegraph in every possible way.

New General Traction Co., Ltd.

The revenue received and accrued during the year ended March, 1916, amounted to £20,289. The profit was £11,300, plus £7,081 brought forward, making £18,381. A dividend of 4 per cent. is recommended, less income-tax, leaving £7,901 to be carried forward. The traffic receipts of the Norwich Electric Tramways Co., Ltd., were fully maintained, and a 3 per cent. dividend was paid for the year ended June, 1915, the same as for 1914. The necessary work of relaying and renewing portions of the track has been continued throughout the year. The Douglas Southern Electric Tramways system has been closed down on account of the war; all expenses have been reduced to the minimum necessary for the safeguarding and upkeep of the undertaking. The income received from the Philadelphia undertaking was £14,238. The balance of the proceeds of the sale of the Coventry undertaking to the municipality has now been distributed, and the company's interest in that concern is, therefore, finally liquidated. Annual meeting: June 14th.

Marconi International Marine Communication Co., Ltd.

The business continued to show substantial expansion during 1915. The net profit amounted to £63,630, after deducting £29,281 for depreciation and debenture interest, compared with a net profit of £55,668 for 1914. Notwithstanding the considerable decrease in passenger traffic, and the necessary restrictions in respect of private messages at sea, the revenue from ships' telegrams, subsidies, &c., amounted to £208,899, a substantial increase over 1914, when it was £175,021. This increase is mainly due to the greater number of ships installed with wireless apparatus. The number of telegraph stations owned and worked by the company as public telegraph stations on the high seas increased from 875 in 1914 to 1,008 in 1915. The organisation of this company, together with that of its associated companies, with a total of some 2,300 mercantile vessels fitted with Marconi telegraph stations, has continued to render inestimable service. The amount of the profit and loss account now stands at £75,062, including £11,971 carried forward. The directors recommend a final dividend of 7½ per cent., which, with the interim dividend, makes 12½ per cent. for the year. The losses sustained in consequence of attacks upon the mercantile fleet during the latter part of 1914 and those incurred during 1915 have now been debited to profit and loss account. Therefore the £10,000 which was placed last year to the credit of a special reserve account to meet any losses arising from this cause remains intact, and it is now proposed to transfer this sum, together with the share premium account, to a general reserve account, which will then stand at £27,639. The continuous growth of the company's business and the large number of additional telegraph stations on board ships, which are being installed year by year without the issue of additional capital, render it prudent to carry forward the substantial balance of £33,841, after providing the sum of £3,500 for the redemption of debentures. During the year under review there has been a net increase of 133 stations, representing a substantial capital outlay for which it would have been impossible to provide without raising additional capital had it not been for the policy of prudently husbanding the cash resources of the company. The balance carried forward will also serve to meet the excess profits duty, which must exceed £8,095, the amount payable under this head for 1914. The

Amalgamated Wireless (Australasia), Ltd., in which this company is interested, has paid a dividend of 6 per cent. for the year ended June, 1915. Annual meeting: June 14th.

United Electric Tramways of Monte Video, Ltd.

During the year ended October 31st, 1915, the gross receipts of the tramway system were $1,553,824, a decrease of $154,061, and the operating expenses were $988,791, a decrease of $45,151. The net receipts were $565,033, a decrease of $99,910, which at exchange of $4.7 to the £ is £21,257. The passengers carried were 40,337,643, a decrease of 3,525,206, and the car miles decreased by 44,070. The percentage of operating expenses to gross receipts increased by 2.78 to 63.64. The further decline in tariffs which was anticipated is attributable mainly to the war. The summer weather conditions were also unfavourable, but conditions in general showed some tendency towards recovery at the close of the year. Further economies in working have produced the substantial decrease in operating expenses. Certain services which had been reduced on the outbreak of war owing to the uncertainty of obtaining coal supplies, have been resumed by municipal regulation, although in some instances they are unremunerative. The charges for freight and insurance have shown an alarming percentage of increase. Owing to the scarcity of shipping, high rates for freight still exist, and the cost of coal delivered in the power-house in Monte Video is now between 150 and 200 per cent. above the pre-war cost. Capital expenditure was £30,482, mainly for paving and rolling stock, the latter ordered before the war. Only 10 cars and 15 trailers had been ordered and supplied. Further expenditure on rolling stock, &c., had been postponed where possible until after the war. The amount receivable from La Sociedad Comercial de Montevideo in respect of revenue was £111,414. The profit and loss account for the year, after providing for administration expenses and charging £48,937 for debenture interest, showed a credit balance of £51,693, plus £12,973 brought forward. There has been put to redemption of debenture stock £3,562, to redemption of preference and ordinary capital £2,500, to renewals and contingencies £20,000. The dividend of 6 per cent. on the preference shares, less income-tax at 3s. in the £, for the year ended March, 1916, required £25,500, leaving to be carried forward £13,103. Owing to the war no dividend on the ordinary shares is recommended. Annual meeting: June 15th.

Reduction of Capital.—*Browett, Lindley & Co., Ltd.*—Mr. Justice Sargant, in the Chancery Division on Tuesday, June 6th, confirmed the reduction of the capital of Browett, Lindley & Co., Ltd., electrical engineers, by a sum of £12,500, being capital lost or unrepresented by available assets. Mr. H. E. Wright, for the company, said the company was incorporated in July, 1899, with a capital of £120,000, divided into 60,000 preference and 60,000 ordinary shares of £1 each. They issued 50,000 preference and 50,000 ordinary shares, all fully paid. The Articles of Association gave the preference shareholders priority as to their cumulative dividend and capital, and to nothing more, and the ordinary shareholders got the rest of the assets in the event of a winding-up. The resolution for reduction threw all the loss on the ordinary shareholders, but a scheme had been arranged, which did not require the sanction of the Court, by which the holders of both preference and ordinary shares would be satisfied. It had been approved by both classes of shareholders. As to the cause of the loss, the company had been compelled to take over investments in satisfaction of bad debts, and these were never worth the nominal value at which they were put into the balance sheet. His lordship remarked that the scheme was of the nature of a bargain.

Ferranti, Ltd.—At an extraordinary general meeting, called for June 16th, a resolution will be submitted extending the borrowing powers, which already stand at £200,000, to £200,000 exclusive of amounts owing or secured to the Government.

Worcester Electric Traction Co., Ltd.—Including £293 brought forward, the accounts for 1915 show:—Available, £4,042; dividend 3 per cent., transfer £1,000 to reserve, carry forward £180.—*Financial Times.*

Marshall, Sons & Co., Ltd.—A financial daily states that the dividend for the year is 7½ per cent., with £10,000 carried to reserve, and £19,633 forward.

STOCKS AND SHARES.

Tuesday Evening.

The first effect of the news of Lord Kitchener's tragic death was to bring business in the Stock Exchange to a standstill. Nobody could believe it possible; and for half-an-hour business was suspended. Then markets quietly returned into something approaching their usual condition. A slight fall in Consols was the only noticeable change. There was no rush to sell; the investor and the community at large take their loss with courage and calmness—eloquent testimony to the confidence with which Lord Kitchener has inspired the nation as to the eventual conclusion of the struggle, come what may in the meantime.

Therefore prices remain firm and steady. The readiness of the investor to buy securities is so great as to give rise to some surprise in the City that the Government do not issue a popular long-dated loan. The public are content to buy Home Railway debenture stocks up to a price that reduces the yield to 4¼ per cent. on the money; and even at this level there is not enough stock to go round.

Industrial markets continue to hold the field for activity and public interest. And the reason for this is simple. Investors find that they have such difficulty in getting even good second-grade stocks that they turn perforce to the ordinary shares, and to such preferences and debentures as are available, particularly those of the best sort, amongst manufacturing concerns.

There is a strong disposition, moreover, to endeavour to discount what is going to happen after the war is over; and money is being directed to any direction which is likely to experience a rebound of prosperity in those days. Interesting problems crop up here-anent; and we have been asked, quite seriously, what price Armstrongs shares will command when peace is signed.

In the industrial markets are to be found wider ranges of selection than other departments afford. The man who holds War Loan says he would not sell it, even apart from patriotic reasons, simply because he does not know in what other stock of similar class he can employ his money to equal advantage. The holder of Colonials re-echoes this sentiment. Meanwhile, money is being piled up in the provinces. A great part of the present national spending consists of transferring bank balances from one set of pockets into another set; and the restrictions laid upon new issues, together with those which militate against realisations by capitalists outside Great Britain, are all points in favour of existing securities here.

Nevertheless, the electric lighting market is dull, and the only two movements on the week are in the downward direction. St. James' fell ⅛, Brompton ordinary ¼. The latter stand at 6¼, and are worth considering by the investor, because the company was one of those which did not reduce its dividend for 1915, and at the present price the return on the money comes to £7 13s. 10d. per cent. No doubt the various calls to economy, daylight saving, linking up, reduction in lighting, and so on, have the effect of keeping money away from this department. But its turn will come some day, of course; and then it will be just as difficult to buy shares as now it is hard to realise them at reasonable figures.

Home Railway stocks were buoyant until Sir Edward Grey's cold douche to the peace expectations led to modification of the buying orders which had been steadily streaming in. North-Easterns keep good, in consequence of the anticipations in connection with the electrification. The Underground list is steady, with recovery in the price of Underground Electric income bonds. It is worth noticing that the return at the present time is 6¾ per cent., which, allowing for income-tax at 5s. in the £, works out to the equivalent of 9¼ per cent., less tax, on the money. No changes worth mentioning have occurred in Districts or Metropolitans.

Telegraphs are good all round. Advances have occurred in the American and the Eastern groups. Great Northerns are up 10s. Westerns gained ½. Globe shares of both kinds participated in the improvements, which, of course, come on the top of gains recently established. A feature is the strength of Marconis, which are 7/32 higher at 2 7/16, on the expectation of a favourable report. The Marconi Marine Co. has done very well, and the dividend is raised from 10 per cent. to 12½ per cent. The company carries forward the substantial balance of £34,000. It is stated in the report that the Amalgamated Wireless (Australasia), Ltd., paid a dividend of 6 per cent. in respect of the year ended June 30th last. The price of Marconi Marines is better at 29s. Oriental Telephone ordinary shares are ⅛ up, and the strength of the market is carried on into the industrial list.

Telegraph Constructions are 30s. higher. There are rises of 15s. in India-Rubber shares, of 10s. in Callenders and in Henleys. Another noticeable spurt in this department is one of 3s. 6d. secured by British Aluminium ordinary, the shares standing now at 27s. 6d., against 20s. a few weeks ago. British Westinghouse preference improved to 2¼. The electrical manufacturing shares, however, have moved in the other direction. Electric Constructions fell 1s. 6d., Edison and Swan fully-paid 2s. 6d. Engineering, iron and steel descriptions are mostly good, and further rises are recorded in some of the chemical shares. Castner-Kellners are 3 7/16 ex the interim dividend of 1s. 9d.

Brazil Tractions are fluctuating sharply. The price rose to 64½, fell 2 points, and recovered to 64, at which it shows a rise of 1⅛ on the week. The buying is attributed to New York. Mexicans are not so good, the news from the country being still vague and unsatisfactory. Nothing fresh has occurred in the British Columbia list. The heaviness of the Anglo-Argentine Tramway group is giving way to a better feeling, but there is no quotable change in price.

The rubber share market keeps firm, upon a recovery in the price of the raw material. Business continues quiet, as compared with what it was six weeks ago. A good deal of money is being put into the shares; and any material

advance in the price of rubber would probably find a scarcity of shares if demand became pressing.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price June 6, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6¼	— ¼	£7 18 10
Charing Cross Ordinary	5	5	3⅝	— ¼	7 2 10
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	5	4	3¼	—	6 8 1
City of London	9	8	12	—	6 13 4
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 3
County of London	7	7	10½	—	6 16 7
do. 6 per cent. Pref.	6	6	10⅜	—	5 15 8
Kensington Ordinary	9	7	5	—	7 0 0
London Electric	4	3	1 3/16	—	7 11 0
do. do. 6 per cent. Pref.	6	6	4¼	—	7 1 2
Metropolitan	3½	3	2⅜	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	3	—	7 10 0
St. James' and Pall Mall	10	8	5¼	— ⅛	6 16 4
South London	5	5	2⅞	—	8 13 10
South Metropolitan Pref.	7	7	1 1/16	—	6 14 0
Westminster Ordinary	9	7	5⅜	—	6 4 5
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102½	+ ½	5 17 0
do. Def.	30/-	33/6	22⅜	+ ⅜	7 10 9
Chile Telephone	8	8	6⅜	—	6 5 6
Cuba Sub. Ord.	5	5	7½	—	6 13 4
Eastern Extension	7	8	14⅛ xd	+ 3/16	*5 13 4
Eastern Tel. Ord.	7	8	142 xd	—	*5 12 8
Globe Tel. and T. Ord.	6	7	12⅜	+ ½	*5 12 0
do. Pref.	6	6	10⅜	+ ¼	5 15 8
Great Northern Tel.	22	22	37	+ ½	5 19 0
Indo-European	13	13	49	—	6 12 8
Marconi	10	—	2 7/16	+ 7/32	4 2 0
New York Tel. 4½	4½	4½	100⅜	—	4 9 4
Oriental Telephone Ord.	10	10	11⅝	+ ½	5 8 1
United R. Plate Tel.	8	8	6 1/16 xd	+ 3/16	*6 6 9
West India and Pan.	1	Nil	19/-	—	9 6 1
Western Telegraph	7	8	14⅝	+ ⅛	*5 9 4
Home Rails.					
Central London, Ord. Assented	4	4	70	—	5 14 4
Metropolitan	1¼	1	25½	—	3 19 0
do. District	Nil	Nil	19½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1 1/16	+ 1/16	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	6	6	87½	+ ¾	*6 17 6
Foreign Trams, &c.					
delaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	3½	—	7 17 2
do. 2nd Pref.	5½	5½	3¼	—	8 9 2
do. 5 Deb.	5	5	77½ xd	—	6 8 7
Brazil Tractions	4	4	64	+1½	6 5 0
Bombay Electric Pref.	6	6	10⅜	—	5 15 8
British Columbia Elec. Rly. Pfce.	5	5	59	—	9 9 8
do. do. Preferred	—	Nil	40	—	Nil
do. do. Deferred	—	Nil	38	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	42	—1	Nil
do. 6 per cent. Bonds	—	Nil	35	—	Nil
exican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	34	—	Nil
do. 1st Bonds	Nil	Nil	42	- 1	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	23	—	5 9 1
British Aluminium Ord.	5	7	27/6 xd	+3/3	5 1 10
British Insulated Ord.	15	17½	10⅝	—	7 2 10
British Westinghouse Pref.	7½	7½	45/-	+1/-	6 13 4
Callenders	15	20	12 xd	+ ½	8 6 8
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	3 7/16 xd	+1/-	5 13 3
Edison & Swan, £3 paid	Nil	—	10/-	—	Nil
do. do. fully paid	Nil	—	1½	— ⅛	Nil
do. do. 5 per cent. Deb.	5	5	57	—	8 15 8
Electric Construction	6	7½	15/8	—1/6	10 6 10
Gen. Elec. Pref.	6	6	9⅜	—	6 4 8
Henley	20	25	15	+ ½	*8 6 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	11½	+ ¾	*8 17 10
Telegraph Con.	20	20	38½	+1½	*6 4 7

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	Receipts for the month. £	No. of weeks.	Total to date. £	Total to date. £	Route miles open.	Route miles open. Inc.
Blackpool-Fleetw'd	May 27	2,041	— 62	21	8,769	— 7	8	..
Bristol (Trams)	,, 26	19,431	—2,027	21	96,714	+ 1,560	30·5	..
Cork	,, 25	2,019	— 178	21	9,662	— 190	54·25	..
*Dublin	,, 26	16,301	—3,029	80	112,350	— 9,845	9·89	..
Hastings	,, 26	3,914	— 69	21	17,278	+ 173	19·8	..
Lancashire United	,, 31	7,115	— 495	22	36,805	+ 1,400	42	..
Llandudno-Col. Bay	,, 26	1,166	— 628	25½	5,757	— 460	6·5	..
Anglo-Argentine	April 22	204,146	—9,685	17	813,468	— 2,933	..	..
Auckland	May 5	21,202	+ 755	44½	231,906	+ 4,808	25·42	1·06
Calcutta	,, 27	17,555	+ 850	21	..	+ 5,572	..	..
Kalgoorlie, W.A.	Feb.	2,348	..	..	4,484	..	..	..
Madras	May 31	3,956	+ 72	21	20,721	+ 1,633	..	..
Montevideo	May	28,349	+ 578	80	215,768	+18,342	..	..
Dublin-Lucan Rly.	May 26	476	— 204	21	2,506	— 358	7	..

* Three weeks.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£54	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£30	..
a Copper Sulphate	,,	£53	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	96/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	,,	£14	..
a ,, Lump	,,	£10	..
a Soda, Chlorate	per lb.	1/4½	..
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1/5 to 1/5½	¾d.—¼d. dc.
c ,, Tubes (solid drawn)	,,	1/5½ to 1/6	1d. dec.
c ,, Wire, basis	,,	1/5½ to 1/5¾	¾d.—1¼d. dc.
c Copper Tubes (solid drawn)	,,	1/7½ to 1/8¼	1¼d. dec.
g ,, Bars (best selected)	per ton	£164	£10 dec.
g ,, Sheet	,,	£164	£10 dec.
g ,, Rod	,,	£161	£10 dec.
d ,, (Electrolytic) Bars	,,	£140	£20 dec.
d ,, ,, Sheets	,,	£158	£20 dec.
d ,, ,, Rods	,,	£147	£20 dec.
d ,, ,, H.C. Wire	per lb.	1/5½	2¼d. dec.
f Ebonite Rod	,,	8/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/7	1¼d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£36	..
g Lead, English Pig	,,	£33 5	5s. inc.
g Mercury	per bot.	£16 12 6 to £16 15	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	,,	£189 to £190	£8—£10 dc.
n ,, Wire, Nos. 1 to 16	per lb.	3/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Rangoon Electric Tramway & Supply Co., Ltd.—The cars carried 10,815,613 passengers, a decrease of 323,335, during the year, the total receipts being Rs8,60,664, a decrease of Rs32,252, or 3.61 per cent. In the private lighting and power department the gross receipts for current amounted to Rs7,32,172, an increase of 13.77 per cent. The gross profits for the year were £63,347. Out of this there is allowed for depreciation on sundry assets in Rangoon £1,847, transferred to reserve for renewals account £12,500, to special reserve for cables, &c., £2,500. A dividend on the ordinary shares of 3 per cent. for the year, tax free, is to be paid, leaving £2,783 to be carried forward.

Russia.—At the annual meeting of the Volta Co., where 13,078 shares were represented, of which the chairman, A. L. Nobel, and the Discount & Loan Bank, controlled 3,000, the accounts presented showed a profit of 394,811 roubles for 1915, or 20 per cent. more than in 1914. The increase was due to better prices and a larger business.

Richardsons, Westgarth & Co., Ltd.—Profit for 1915, £76,241. After paying debenture stock interest, providing for depreciation, writing off capital expenditure, &c., there is a credit balance of £17,511. Special contracts received early in 1915 were not sufficient to compensate for the large amount of mercantile work hung up.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended April 28th, 1916, amounted to 1,917,213, compared with 1,804,722 units in the corresponding four weeks of 1915.

Canadian General Electric Co., Ltd.—Dividend on the common stock for quarter ended June, 1¾ per cent. (7 per cent. per annum).

Mackay Companies.—Quarterly dividend, 1¼ per cent. on the common stock.

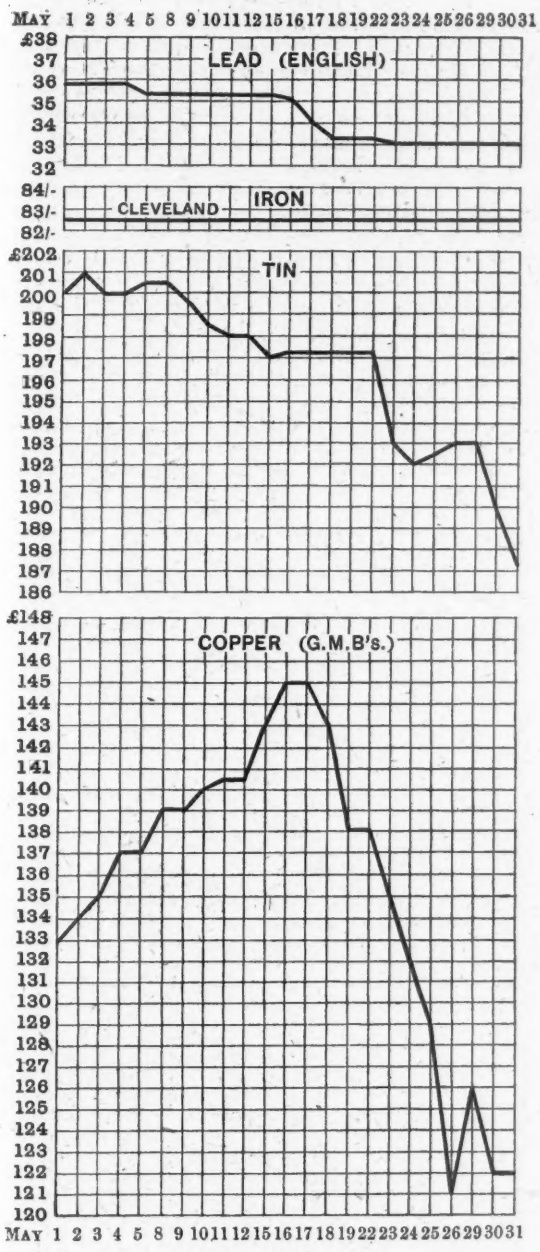
Brazilian Traction, Light & Power Co., Ltd.—Quarterly dividend of 1½ per cent. on the cumulative preference shares.

Western Telegraph Co., Ltd.—Third quarterly dividend, 3s. per share (6 per cent. per annum), free of tax.

Commercial Cable Co.—Quarterly dividend, 1¼ per cent.

METAL MARKET.

Fluctuations in May.



Electricity Works and "Excess Profits."—The *Financial Times*, writing editorially on the problems of the Excess Profits Duty, refers to the case of electric supply companies, which are in a peculiar position in regard to the Act, as follows:—"Mr. H. B. Renwick, who is closely associated with the working of such undertakings, and who is an authority on electrical finance, reminds us that these concerns work under such special restrictions, that it would be most inequitable for the present statutory percentage standard to be taken to apply to such undertakings without increasing it by at least 4 per cent. The electric supply companies are under statutory obligations to provide machinery, to lay mains, and to give supply wherever required under their orders, thus necessitating a continuous expenditure of capital in advance of profitable demands, with the result that ordinary shareholders have to go without dividends for many years in the earlier stages. Further, the companies have a very limited tenure, mostly from 33 to 42 years, during which to earn a return on their capital, and at the end are subject to purchase under conditions which are particularly onerous. They have, therefore, necessarily to look to the latter years of their tenure to compensate for the unproductive early years, and to make provision for loss of capital. Certainly these factors should be taken into consideration, and there seems good ground for a modification of the rate by the Board of Referees."

LABOUR AND INDUSTRY.

(*Continued from page* 612.)

At one critical stage of the war, when the need for expediting the raising of the new armies and the production of munitions was very real, there was such a strong feeling exhibiting itself in some Labour conferences that it seemed possible that it might be necessary for the Labour representatives to leave the Coalition Government. It is a matter for gratification that that was not the upshot; and while it cannot be said that the Labour representatives in the Government have the unanimous backing of the workers' organisations, the presence of Mr. A. Henderson and his colleagues has been responsible for the smoother running of the industrial wheels. We believe that it will be in that direction, rather than by any direct initiative exercised in the office over which he more particularly presides, that the President of the Board of Education will be found to have served the nation by his counsels in the Cabinet. But though Labour in some of its parts would have liked to hold aloof from the Coalition, we find it, in others, expressing a strong dissatisfaction with the constitution of some of the Committees that have been set up by the President of the Board of Trade to study after-the-war trade problems. It will make its voice heard when we come to the question of adopting new national policies; and it does not see why, in forming Committees which are to make suggestions for the future safety and development of industries which involve the security and prosperity of the workers, it should be ignored. There may be, and probably is, some justification for that attitude, but so much must depend upon what these Committees are expected to do. If their sole thought is to be devoted to suggesting, as the result of their specialised industrial and trade experience, effective ways in which we may ensure ample prosperity of their own class of industries—that is, increased turnover and a satisfactory rate of profit, also the safety of "key" industries—they will almost certainly be all the time studying means which shall safeguard employment for the worker. To secure or increase the volume of industry will be to provide for work and wages in those trades; but we do not see the absolute necessity of Labour men sitting on Committees where for the most part the problems arising will be quite foreign to what they are in the habit of considering. Educationally, no doubt, it would be for their good and for the good of Labour that they should learn at close quarters what have been, and will be, the acute problems of the industrial employer, but—we hope that we can say it without being misunderstood—they could hardly expect to bring to a gathering of employers a counsel of ripe experience in actual trade and industry which could assist such Committees to arrive at better conclusions than they could reach alone. Briefly, it is a case where the employer, in thinking out what is best for the national industries, and, therefore, what is best for himself and his colleagues as units in those industries, is studying the interests of Labour. Perhaps Labour will be able to suitably represent its cause in the form of evidence before the Committee. When recommendations are made, and the Government of the day evolves a policy based thereon, Labour will be well able to protect itself if it finds itself in disagreement with the proposed policy, or policies. At the present juncture, Labour politicians would be better able to serve the ultimate best interests of the nation by stimulating a healthy Labour attitude in the different industrial centres of the country, than by aspiring to scatter themselves over a number of Parliamentary Trade Committees. Labour needs strong and timely leadership to prevent an irreconcilable spirit from becoming dangerous in the critical days that must almost inevitably follow the war, and if it can be led along the lines adopted by Mr. Hodge, M.P., and his colleagues in the League referred to last week, well and good; if the workers can be induced to listen, there are many useful and educative truths that may be spread broadcast, and with urgency and emphasis. For example, if one thing is more certain than another, it is that, considering the demands of the Colonies and of the Allies, who will reduce their trade connections with the Central Empires if it be made possible for them to do so, we shall have to be equipped in every

way with modern and efficient management, with scientific insight and oversight, with increased manufacturing capacity, and with increased efficiency of Labour, and more of it. It will be of little avail for Labour, as representing the workers, to cry out against future trade with Germany, if by its policies, and by reluctance to comply with the necessities of the new situation, it is going to clog the wheels of our industries. There never was a time when harmony and co-operation between Capital and Labour were so urgent a matter as they will be when the economic position assumes its next phase—as the Government ceases to be the employer of millions, when the high wages of a national emergency cannot be paid out of trade as they are now being paid out of national capital, and when the excess profits drawn from war business give way to the much smaller ordinary profits of every-day trade.

There is one aspect of the work of these After-the-War Trade Committees which, to our mind, bids fair to affect Labour very materially—we refer to its suggestions for increasing our share of trade with colonial and foreign markets. By adequate regard being paid to our national representation throughout the world, we could do vastly better than we have done in the past. We have for years witnessed the efforts of the Teuton to wrench from the British grasp by dint of Governmental and financial force, and to filch, by characteristic underhand methods, our trade connections, not entirely for the purposes of legitimate business, but for other ends which are now revealed in the clear light of day. Our national weaknesses in such matters have been fully availed of by the enemy, and we have largely to thank ourselves that we have afforded him the opportunity to work his dark designs and strengthen his movement towards Commercial Domination. Too many people seem to overlook the fact that one aggressive, enterprising representative abroad may, by the timely and appropriate exercise of business ability and adequate knowledge, secure for British factories work which may employ thousands of British workers for a year. This is so elementary a thing that we dare hardly utter it again here; it is, of course, mainly a matter calling for initiative on the part of manufacturers and financiers, commercial men, and, at times, concession-hunters, either individually or collectively; but the worker needs to recognise these common trade truths so that he may see how important it is that in such representation we should have support of the utmost efficiency in the form of Governmental assistance. We refer to such matters as Consular activities, trained and accredited Commercial attachés, and Trade Commissioners. Labour will not be slow to see that the expenditure in such ways of hundreds of thousands of pounds annually may be a profitable national investment in the interests of the worker. It needs to have a vision of the developing world which none can give it in more appropriate manner than some of its own Leaders, who, as they tell us, have seen the Union Jack flying from the lonely shack in Canada, West Australia, and so on, and have observed the spirit of Home and Empire so warmly displayed. Surely, if the workers can be brought to see something of the immensity of the demands of the thousands of millions of population in other lands for manufactures which they cannot yet produce for themselves, if they will ever be able to do so, they will see that there ought to be "work for all," and no complaining in our streets, if only we avail ourselves in an awakened manner of the world's opportunities as they will present themselves when the nations gradually feel their way back to normal life again. We repeat that this is a question for Labour quite as much as for Capital, and we consider that Labour should, and probably will, as it comes to a better understanding of the difficulties of British industry in the past, see that the demand for a more extensive and more efficient organisation of Governmental fostering of trade by official overwatching in all parts of the Globe, is not a selfish cry from a few manufacturers, as the representatives of capitalists, as has sometimes been suggested, but is a reasonable demand made in the interests of national industry, which, if satisfied, should go far to provide that "work for all" *who desire it*, which employers are anxious to be able to give.

In some trades, and more particularly those connected with engineering and electrical pursuits, there is considered to be a large reservoir of orders accumulating which will await execution after munitions are done with, and the increased works and plant capacity, when adapted, will certainly require all that business to keep it occupied. No doubt for some years to come also there will be very large requirements from countries where the destructive effects of war have been so great; but a revision of our Consular and trade representation system and service should not be delayed because of the arrears of orders and the work of rehabilitation that await us. In this matter it is in the interests of industry, and therefore of Labour, that we act in time, for the problem of finding ample work for all will be more acute after a year or two than it may be at once. The difficulties of readjustment consequent upon the transfer of labour from different places and from different industries may be enormous, but the need for increased volume of some classes of trade will probably make itself keenly felt a little later. Organised Labour, therefore, needs, in whatever policy it adopts, to be very long-sighted; some of these matters which appear at first sight to be questions for the master, are far from remote in the interest that they possess for the worker. Indeed, here again we need to make it known that the interests of employer and employé are, in the main, alike; they only differ in degree.

(To be continued.)

ELECTRICAL PRECIPITATION OF SMOKE AND DUST.*

By HALBERT P. HILL.

Electrical precipitation has proved an effective method for obviating smoke and dust and for the recovery of solids suspended in gases.

The writer has conducted a number of experiments under many varying conditions on various materials to determine the most practical ways of making electrical precipitation effective. The first apparatus used consisted of a 7·5-kw. motor-generator set operated from 220-volt direct current, generating alternating current at 154 volts, 60 cycles, single-phase. This unit was connected to a transformer with primaries arranged with six taps so that secondary voltages of 40,000, 50,000, 60,000, 70,000, 80,000 and 100,000 were available. In order to get a finer adjustment a variable resistance was connected between the taps, so that it was

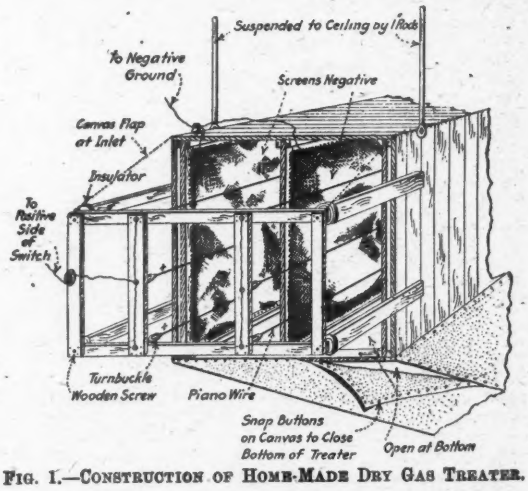


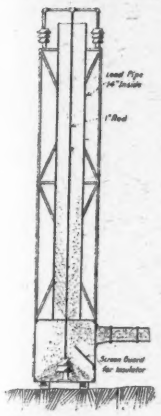
Fig. 1.—Construction of Home-Made Dry Gas Treater.

possible to secure voltages in 1,000-volt steps from 40,000 volts to 100,000 volts, and ratings from 2·5 kw. to 7·5 kw. The secondary of this transformer was connected to a rotary rectifying switch which rectified the current into a pulsating unidirectional current. From the switch the high-tension wires were carried to the treater. Since the experiments were being conducted on relatively cold gases, at a temperature seldom exceeding 200° F., a wood box 8 ft. long, 6 ft. wide and 4 ft. deep was used, in which wooden frames covered with copper screens of No. 100 mesh were mounted. There were six screens, and all were connected to the ground. An insulated frame was provided at each end, and between each screen three piano wires were so spaced that they were 10 in. from

* From the *Electrical World*.

each screen and 10 in. apart. All these wires were connected together and formed the positive pole (fig. 1).

This treater was used in conjunction with an atomising house, where fluids containing solids, such as milk, salt solution, and various chemicals were atomised. By applying heat and spraying the solution in the room, a large percentage of the solids would fall to the floor as a powder, but from 15 to 20 per cent. was carried off in the exit gases. Various mechanical means for the recovery of the solids carried away in suspension were tried, but the electric treater was found the most effective and dependable. Serious difficulties were encountered at first with the treater, as long sprays of the product would build up and cause the treater to arc. Mechanical means for shaking the screens were provided which proved quite effective. Another difficulty was encountered in building a transformer that was dependable for the service, as the end coils would gradually disintegrate owing to corona. It was only after numerous experiments that it was possible to correct this difficulty. The first experiment was conducted with a disk switch having four contacts 90° apart, with one strap connecting



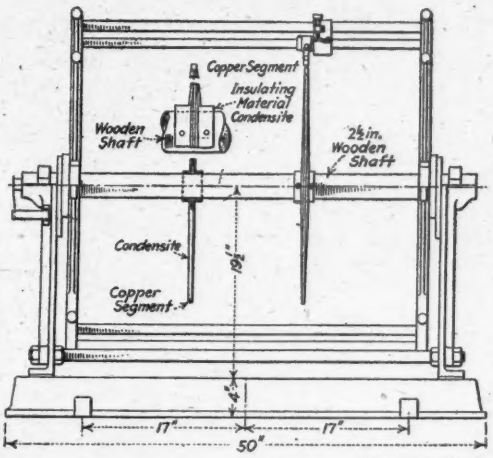


FIG. 2.—SECTION THROUGH TREATER FOR HOT GASES AND SMOKE.

the top and right-hand stud, and a second strap connecting the bottom and left-hand stud (fig. 3). In front of these two studs a second disk was mounted with four contact shoes each about 10° long, and to the top and bottom studs were connected the high-tension secondaries from the transformer. The right-hand and left-hand studs were connected to the treater. The right-hand stud, being positive, was connected to the positive wires, with the negative left-hand stud connected to the screen or ground.

With switches of this character, as well as two-arm and four-arm rectifier switches, in the beginning only 10 per cent. of the wave was rectified. Finally the shoes were increased until 70 per cent. of the wave was rectified. Trouble still developed in the transformers, however, caused by the fact that the treaters had high condenser capacity, and the current commutated arced from the rotor arm to the shoe, so that a high frequency was set up. The experiments seemed to show that the longer the arc or the greater the portion of the wave that was commutated the less current it was necessary to

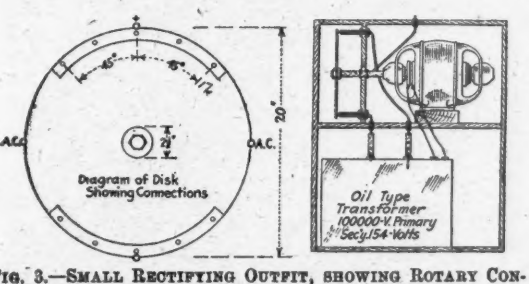


FIG. 3.—SMALL RECTIFYING OUTFIT, SHOWING ROTARY CONVERTER, RECTIFYING SWITCH AND TRANSFORMER.

use to get good results on the treater. As an illustration, when handling 80,000 cb. ft. of vapour containing about 15 per cent. of milk powders and solutions, 50 milliamperes at 70,000 volts was used with a switch having shoes commutating 10 per cent. of the arc. When these shoes were increased to 60° it was possible to operate with 50 000 volts and about 35 milliamperes. Afterwards a switch was substituted consisting of two disks with two copper selectors bolted to the sides, the selectors being 80° each, and four brushes made of hack-saw blades resting on glass plates. The plates were 22 in. in diameter, and ¼ in. thick, and were mounted on aluminium quills. These were slid over a wooden shaft; the whole was mounted in a cast-iron frame, and the brushes were supported on condensite tubes. This made a positive contact-switch commutating 80° of the wave. There was very little sparking, as the break occurred 5° in advance of the zero line, and the voltage was quite low at this point. It was found that more of the product could be handled by the treater with 27 milliamp. and 40,000 volts and this type of switch than with a make-and-break switch using practically twice the electrical energy. Using this type of switch corona on the transformer was practically eliminated.

Tests were conducted to determine the actual advantages of using a positive contact switch. It was found that the frequency was over 350,000 oscillations when using the make-and-break switch commutating 10° of the arc, and when using the positive contact switch commutating 80° of the arc, the frequency dropped to about 40,000 oscillations. The results of the experiments seemed to prove that the ideal method would be to employ static machines. They, of course, could only be used in very small plants owing to their limited capacity and the uncertainty of operation in damp weather. The next approach to static machines is the positive-contact switch and a 40-cycle to 60-cycle source of supply. The writer believes it a mistake to commutate only the apex of the wave, and also a mistake to use too low a frequency. Assume that a given weigh of materials passing through a treater at a given velocity it attracted by a certain force and a certain number of times per

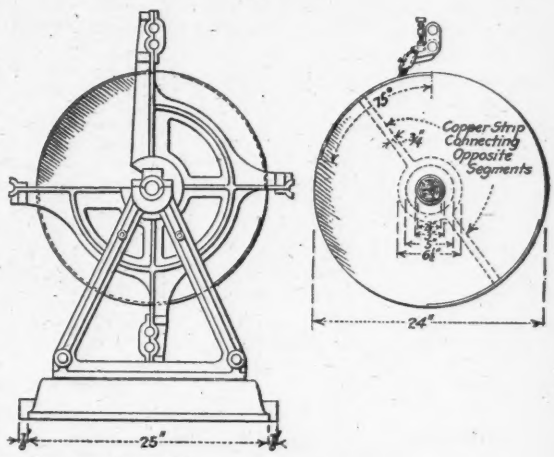


FIG. 4.—POSITIVE-CONTACT SWITCH.

second, always bearing the fact in mind that when the contact at the switch is broken the treater charges and discharges and the velocity of the materials must necessarily be retarded a certain percentage because of the discharge of the treater. Therefore, with the positive-contact switch, the materials passing through the treater take on a charge, or each particle stores up a certain kinetic energy which will carry it a fixed distance, so that the nearer a true direct current or a uniform positive charge can be applied to the substance in suspension the greater attraction will be imparted to each particle and a more perfect precipitation secured.

A number of experiments have also been conducted on tube-type treaters, laying them flat and passing the gases through them at a fixed velocity; standing them on end and admitting gases through the bottom; and standing them on end and admitting gases at the top (fig. 2). The best results were obtained when the gases were admitted at the top, as the weight of the material as well as the momentum imparted by the velocity tended to deposit it in the bottom of the chamber or the treater. Experiments were conducted operating the apparatus at various frequencies from 25 cycles to 100 cycles, and while at the higher frequency better results were obtained, for commercial efficiency 40 to 60 cycles was deemed best, as this allowed a speed of 1,200 R.P.M. at 40 cycles for the switch and 1,800 at 60 cycles. The size of the transformers and the cost of the apparatus were in favour of the 60-cycle equipment.

The size of the treater and the proportioning of the positive and negative elements are important considerations. Owing to the extremely large condenser effect of the treaters, great care should be exercised in the designing of a transformer to operate in connection with them. The windings should be protected with mica insulation, and as each end of the transformer is alternately grounded at every alternation, extreme care should be taken in insulating the coils from the core. The best design of transformer seems to be a square magnetic circuit with a primary wound in the bottom and a secondary in the top. The secondary should be divided into at least four coils, and should be spaced at least 6 in. apart and well insulated with oil. All the transformers used by the writer were put up in steel cases, with the terminals 17 in. apart. The 5-KW. and 7·5-KW. sizes were designed for continuous operation at 40° F. rise in temperature. Owing to the length of the magnetic core and spacing of the coils to get proper insulation, there is considerable leakage in these transformers, which, however, is not an objectionable feature, as there are frequent short-circuits in the treaters, and this leakage is an advantage during periods of short-circuit.

A peculiar condition that the writer has never satisfactorily accounted for is that the insulation on the alternator seems to break down, particularly on the collector rings, and for no apparent reason. After operating a rectifier with a positive-contact switch, this trouble seems to have been eliminated.

The field for electrical precipitation is very large. The apparatus can be successfully used for abating smoke nuisance, provides an ideal means of removing the soot, clinker and ash in blast-furnace

gas which is so objectionable when used with gas engines, and may be used in cement mills and in conjunction with smelters.

In the *Electrical World* of May 13th, Mr. E. R. Walcott described an electrostatic voltmeter reading up to 75,000 volts for use in connection with the precipitation of smoke and fumes. It is constructed on the principle of the Kelvin guard-ring electrometer, comparing the electrostatic attraction due to the pressure with the gravitation of a small weight under zero conditions. The instrument is said to be accurate to one part in 1,000.

THE DUBLIN TRAMWAYS AND THE IRISH REBELLION.

We are indebted to Mr. Marshall Harriss, general manager of the Dublin United Tramways Co. (1896), Ltd., for the following interesting particulars and views of the stirring events which took place recently in the Irish Capital.

We feel sure that our readers will join with us in congratulating

Dublin Tramway Standard, showing Shell Hole.

the company and its officials on having escaped what might have involved much more serious loss.

At the commencement of the trouble on Easter Monday, at 12.30 p.m., immediately after the Sinn Feiners occupied the principal public buildings, the Tramway Co. commenced to withdraw its cars from the city, and at 2.30 p.m. most of them were safely in the different depôts.

In Sackville Street, however, one of the Howth cars was stopped, and the motorman and conductor covered with revolvers and ordered to leave. An attempt was made to upset this car by hand, to form a barricade for Earl Street, but failed, and subsequently a charge of dynamite was exploded underneath it, but did little or no harm. Eventually this car was burnt, due to the adjoining house having caught fire and fallen upon it. Another car was caught on the South Quays, and was also burnt in the same way, and minor damage was done to four or five of the cars by rifle fire. The trolley-wires suffered most severely, several miles being brought down all over the city by rifle fire. Several tramway standards were also damaged by shell fire, and one of the views shows a standard at the corner of O'Connell Bridge and North Quays through which a shell passed. Subsequently this pole, and others which were damaged, were filled up with concrete, reinforced with steel rods, on site.

The day after the outbreak the Sinn Feiners surrounded the power station, and eventually entered and ordered the men out. The rebels carried revolvers, and some of them a revolver in one hand and dagger in the other. They gave the engineer on watch an hour to clear out, under penalty of death, and ordered the whole system to be shut down. This was exactly what it had been decided to do by the officials of the company. However, the Sinn Feiners were apparently satisfied that their wishes were carried out, as they did not return, and the staff remained in occupation of the station in its shut-down state throughout the whole of the disturbance, notwithstanding the heavy rifle-fire in the district, which was one of the worst situated, and was the last to capitulate. No attempt was made to do any damage to the power station, nor, indeed, was any direct attempt made to damage the cars except from the Sinn Feiners' military point of view.

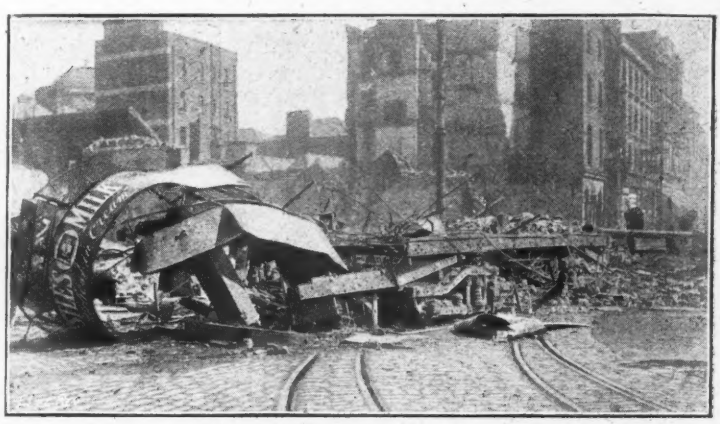
One of the motormen, in getting his car away from the danger zone, was shot and seriously wounded, and another, coming from a city depôt, was shot dead by rifle-fire from the General Post Office; several other tramway employés were also shot by stray bullets in the vicinity of their own homes. The loss included the two cars referred to and the damage to the overhead system, but the loss of traffic was the most serious matter that the Tramway Co. has experienced.

On May 2nd, immediately after the burning of the General Post Office, the fires in the power station were restarted, and on May 3rd most of the system was in working order.

Sniping was very prevalent throughout the whole of the system, which made it very uncomfortable for the men repairing the overhead wires; but by May 5th practically every feeder was temporarily repaired and the service restored as far as allowed by the military authorities, who had drawn a cordon around the whole city, and would not allow the cars to pass more than two bridges—one on the south side and one on the north side.

The total damage to the rolling stock, including the two cars destroyed and injuries to six other cars—mainly breakage of glass by rifle fire—did not much exceed £1,500; the total damage to the overhead system amounted to about £500. Considering, however, the amount of property the company had throughout the city—the various depôts and large number of cars—the company may be congratulated on their good fortune. The system was at a standstill from 12.30 p.m. on Easter Monday, April 24th, until May 3rd.

One of the views shows the Howth car referred to, which was burnt; this car, as well as a smaller one destroyed on the South Quays, was eventually towed home on its own wheels. The field coils of the motors were destroyed, but the armatures are apparently not very much the worse. Notwithstanding that the metal melted from all the bearings, the trucks are not beyond repair. No damage appears to have been caused to the truck as the result of the attempt to blow the car up.



Dublin Car Destroyed during the Irish Rebellion.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Shop-window Reflector.

It is gradually becoming recognised that a shop window may be even more effective as an advertisement by artificial light than by daylight, owing to the precision and flexibility with which the illumination can be arranged.

Considering the variety of conditions which have to be dealt with, the demand for an unusually efficient mode of shop-window illumination might seem beyond the range of practical engineering. But a method has been devised for illuminating the typical deep shop-window in such a way that every article placed in it, in any position, is lit to the best advantage. The means by which this result is obtained will be clearly understood from the accompanying diagram—fig. 1.

The diagram shows how these limitations are avoided in a new system of reflectors that has just been brought out by the General Electric Co, Ltd., of London. By arranging plain mirror reflectors of certain dimensions and of certain angles, in a conchoidal curve, with lamps about 18 in. apart at the focus of the curve, a complex system of direct and reflected light is obtained. The multiplication of reflectors at different angles prevents the streaki-

ness which is usually the result of using plain mirrors; and the general effect is that articles set in any position within the window are bathed in light from every side. At the same time, no light, either direct or reflected from the mirrors, falls in front of the window line; nor are the lamps visible to the public. The stage effect so much sought after is thus retained, with a complete

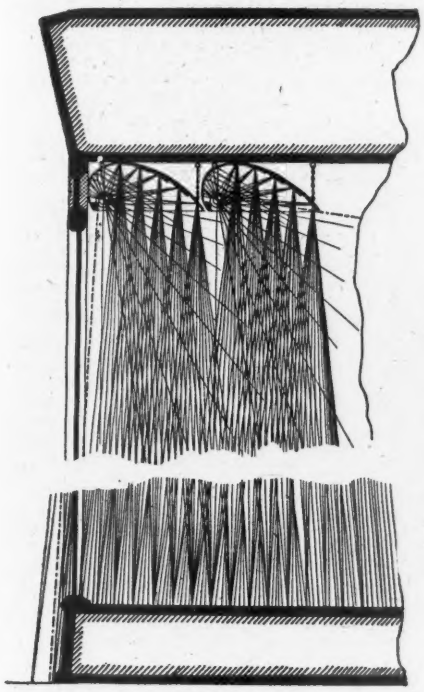


FIG. 1.—DIAGRAM SHOWING REFLECTED LIGHT RAYS IN THE G.E.C. NEW REFLECTORS FOR SHOP-WINDOW LIGHTING.

absence of glare or harsh shadows. It will be seen from the diagram that, from the point of view of effective illumination, it is a matter of indifference how the articles in the window are arranged.

This method of lighting has already been put to the practical test in the window-lighting of large drapery establishments, and has proved completely successful. It provides, in the simplest possible manner, an ideal mode of illumination, and, moreover, it is adapted to the present lighting regulations, which prohibit the overflow of light on to the pavement.

Numerous other applications of this ingenious system of reflectors might be suggested. Stage-lighting is one of the most obvious; and in happier times than the present it will find its use for poster and sign illumination.

"Zedlite" Electric Candles.

THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD, of Southfields, S.W., have issued a leaflet dealing with their electric candles.

The "Z dlite" candle, fig. 2, is claimed to resemble closely its waxen predecessor; it consists of only two parts, the lamp and the opal tube to slide over the latter, which can be removed for cleaning without disturbing the lamp.

The makers claim that it is the only electric candle that remains upright, being unaffected by vibration. It has been extensively used in the Piccadilly Hotel and many large houses. It is sold for

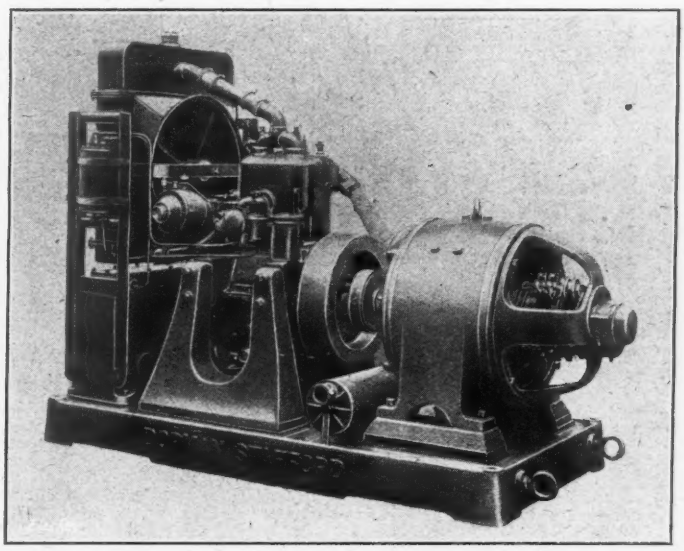


FIG. 4.—DORMAN 8-10 KW. PETROL-ELECTRIC SET (see p. 664).

circuits of 20 to 250 volts pressure, and in candle-powers from 8 to 16.

Lee Electric Water-Heater.

THE LEE ELECTRIC RADIATOR CO, of Chicago, has placed on the market the electric water-heater shown in fig. 3. The most popular sizes in use are the single-heat elements of 500 and 750 watts, although the line is completed with 1,500 and 2,000-watt sizes with three-heat control.

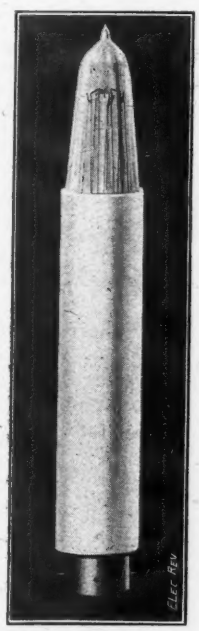


FIG. 2.—"ZEDLITE" ELECTRIC CANDLE.

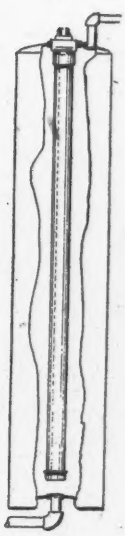


FIG. 3.—ELECTRIC WATER-HEATER.

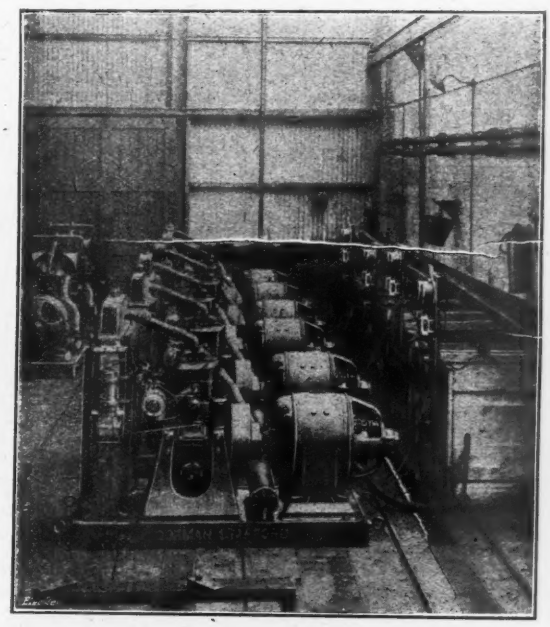


FIG. 5.—DORMAN PETROL-ELECTRIC SETS UNDER TEST (see p. 664).

In construction the water-heater is like a pipe or rod 1·25 in. in dia., 56·5 in long, and threaded for one inch at the top, so that it is only necessary to insert this unit through the standard opening in the top of any ordinary range tank. The pipe is filled with an insulating, non-oxidising fluid, in which is submerged an open resistance-coil or heating element.

Dorman Petrol-Electric Sets.

MESSRS. W. H. DORMAN & CO., LTD., of Stafford, have been supplying for Government lighting and power uses a number of their standard 8-10 KW. self-contained petrol-electric sets, which we illustrate in figs. 4 and 5 (p. 663). Engine, generator, fan-cooled radiator, fuel tank and silencer are all mounted on one bedplate.

The engine is the firm's standard two-cylinder vertical water-cooled monobloc type 120 mm. bore × 140 mm. stroke, capable of developing 18 B.H.P. at 1,000 R.P.M. on petrol; it can also be adapted to run on paraffin, in which case petrol is used for starting.

A special type of centrifugal governor is provided which controls the voltage within 5 per cent. between full load and no load. The lubrication is automatic, the oil being forced to all the bearings under pressure through a drilled crankshaft from an oil pump in the base chamber; oil level and circulation indicators are provided. The engine is coupled to the dynamo through a flexible coupling.

The fuel tank is mounted above the base plate, the starting handle of the engine being carried in bearings integral with this tank. The fuel is lifted from the tank to the carburettor or vaporiser on the engine by means of the "Auto-Vac" patent feed system.

The radiator is mounted above the fuel tank, the circulation being by thermo-siphon; the radiator is cooled by a large diameter fan driven by a Whittle belt from the engine shaft.

The silencer is carried on the bedplate.

The total net weight of the set as shown in the views is approximately 35 cwt.

These sets have proved exceedingly convenient for both permanent and emergency purposes; the petrol consumption is approximately 1·6 pints per KW.-hour, and the plant will run continuously with the minimum of attention.

Such plants are built in sizes ranging from 4 KW. up to 30 KW.

Full particulars of the engines are contained in the firm's sectional catalogue No. 20.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TRANSIT OF GOODS THROUGH FRANCE.—An official statement has been published in the *Board of Trade Journal* of May 11th, giving full particulars of the arrangements for transit through France of goods sent from the United Kingdom to Switzerland, Italy, and Spain *viâ* France. Goods sent by parcel post to Spain may pass in transit through France without special formality. In the case of Switzerland and Italy, however, a special label indicating that exportation has been licensed must be affixed to the parcel. Special facilities exist for the transmission to the Société Suisse de Surveillance Economique of parcels by post weighing less than 11 lb. gross, and containing certain specified goods. Full information is available at the Commercial Intelligence Branch of the Board of Trade.

BRITISH DOMINIONS, COLONIES, &c.—The Board of Trade have received information that Consular Certificates of Origin are not now required for goods shipped from Italy to British oversea ports.

UNITED KINGDOM AND CERTAIN FOREIGN COUNTRIES.—A Supplement to the *Board of Trade Journal* of May 18th contains complete lists of articles which are prohibited to be exported from the United Kingdom, and certain foreign countries, viz.: Denmark, France, Greece, Italy, Japan, Netherlands, Norway, Portugal, Roumania, Russia, Spain, Sweden, and Switzerland. The list of articles prohibited to be exported from Sweden is based upon information received at the Board of Trade up to May 15th, and should be of considerable interest to British exporters to Russia in view of the application of the Swedish prohibitions to goods passing in transit through Sweden to Russia. The present Supplement supersedes that issued on February 17th last. Copies may be obtained, price 3d. (3½d. post free), from the usual sale agents for Government publications.

CAMEROONS.—The former German Customs Tariff remains in operation. According to the Comptroller of Customs, Nigeria, goods for the Cameroons may be entered at Victoria, where a Custom House has been opened, but goods for Rio del Rey are required to be entered at Calabar. The specified schedule of import duties includes "articles of iron of all kinds," which pay an *ad valorem* rate of 20 per cent. All goods not mentioned in the schedule and not exempted from import duty pay 10 per cent. *ad valorem*. Among the articles on the free list are appliances for wireless and cable telegraph stations; machines and implements of all kinds.

An export duty of 40 pfennige per kilog. net (about 2d. per lb.) is payable on rubber, except plantation rubber.

ST. VINCENT.—By an Order-in-Council, dated March 17th, previous Orders issued in March, 1915 (under which an additional duty of 20 per cent. was levied, with certain exceptions, on dutiable articles imported into the Colony) are rescinded, and new additional duties are imposed in lieu thereof, including an increased duty of 10 per cent. on all articles other than tobacco, wines, and spirits.

NORWAY.—The exportation of worked, unworked, and scrap platinum has been prohibited.

FRANCE.—The Bill proposing to authorise the Government, while hostilities continue, to prohibit by Decree the importation of foreign goods, or to increase the import duties thereon—*vide* the REVIEW of May 12th—has now become law.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

7,244. "Electrodes of electric melting and heating furnaces." S. DAVENPORT & V. STOBIE. May 22nd.

7,252. "Electric devices for automatically turning lights on and off." E. STEIGER. May 22nd.

7,255. "Loading coils." BRITISH INSULATED & HELSBY CABLES, LTD., AND H. H. HARRISON. May 22nd.

7,258. "Call-distributing telephone systems." WESTERN ELECTRIC CO. May 22nd. (U.S.A., May 22nd, 1915.)

7,275. "Electric heating apparatus." E. ERICHSEN. May 22nd.

7,288. "Miners', &c., electric lamps." F. J. TURQUAND. May 22nd.

7,291. "Refillable fuse plugs." J. G. CLEMENS. May 22nd. (U.S.A., May 25th, 1915.)

7,303. "Shadeholders for artificial lights." A. HAGUE. May 23rd.

7,305. "Stands or pedestals for electric lamps." W. J. FURSE & CO. AND W. F. FURSE. May 23rd.

7 314. "Adapter for electric signalling lamps." R. A. WICKENS. May 23rd.

7,328. "Multicore electric cables." CALLENDER'S CABLE & CONSTRUCTION CO. AND J. O. CALLENDER. May 23rd.

7,334. "Telegraph key." F. PALMER. May 23rd. (New Zealand, May 29th, 1915.)

7,335. "Telephony." L. C. BYGRAVE & RELAY AUTOMATIC TELEPHONE CO. May 23rd.

7,336. "Thermo-electric switches." RELAY AUTOMATIC TELEPHONE CO. AND G. K. ROBERTSON. May 23rd.

7,347. "Means for earthing electric conductor conduits." L. R. LACY AND G. RUSHTON. May 23rd.

7,380. "Electric lamps." J. MERSING. May 24th.

7,392. "Electric ignition or sparking arrangements." W. A. BRISTOW, H. W. F. IRELAND AND SIEMENS BROS. & CO. May 24th.

7,456. "Electro-chemical microphones for wireless telephony and telegraphy, &c." S. FORD & A. F. SYKES. May 25th.

7,471. "Electrical lock and commutator for railway signal levers." W. D. PARR. May 25th.

7,497. "Hygienic appliance for telephones," E. LEMAITRE. May 26th.

7,517. "Sparking plugs." A. E. LAMKIN. May 26th.

7,518. "Electric ship propulsion systems." R. V. MORSE. May 26th.

7,535. "Spark plugs." A. C. FERRIER. May 27th.

7,540. "Transmitting gear of ships' telegraphic, &c., apparatus." G. W. HASTINGS & A. ROBINSON & CO. May 27th.

7,543. "Morse signalling for aircraft." C. M. BOSTOCK & R. N. COKE. May 27th.

7,567. "Separators for secondary batteries." W. J. MELLERSH-JACKSON (India-Rubber Co.). May 27th.

PUBLISHED SPECIFICATIONS.

1914.

17,872. CONSTRUCTION OF HIGH-FREQUENCY ALTERNATORS. Soc. Marius Latour et Cie. July 28th. (November 22nd, 1912. Divided application on 26,934/13, November 22nd.)

1915.

2,404. ELECTRO-MAGNETIC DRIVING MECHANISM. T. Rushton & Coventry Electric Clock Co. February 15th. (August 13th, 1915.)

3,760. INCANDESCENT ELECTRIC LAMPS. A. A. Canton. March 9th.

6,296. ARC LAMPS ADAPTED TO BE USED ALSO FOR THE PRODUCTION OF ELECTRIC OSCILLATIONS FOR WIRELESS TELEGRAPHY, WIRELESS TELEPHONY, AND FOR OTHER PURPOSES. L. Mauclaire & A. Bréon. April 27th.

6,647. SOUND DIRECTING APPLIANCES FOR USE WITH TELEPHONES AND MICROPHONES. E. M. C. Tigerstedt. May 4th. (May 20th, 1914).

6,674. SYSTEMS FOR THE PROTECTION OF ELECTRIC CABLES IN THE EVENT OF EXTERNAL DAMAGE. C. J. Beaver & E. A. Claremont. May 4th.

6,818. AUTOMATIC SWITCHES OF ELECTRIC TRAIN LIGHTING SYSTEMS. W. King. May 6th.

6,930. ELECTRIC MEASURING INSTRUMENTS. A. Philip & L. J. Steele. May 8th.

6,980. JOINT FOR AN ELECTRIC CABLE. A. E. Tanner & E. A. Claremont. May 10th.

7,025. ELECTRIC TIME ALARM AND CALL SIGNALS. F. L. Cantrall. May 10th.

7,177. SWITCHING-OVER SYSTEMS FOR ELECTRICAL LIGHTING INSTALLATIONS FOR RAILWAY TRAINS AND THE LIKE. H. Grob May 12th.

7,308. ELECTRIC SWITCHES. G. Webb. May 15th.

7,324. SHIPS' STOKEHOLD AND ANALOGOUS TELEGRAPHIC APPARATUS. W. Chadburn & Chadburn's (Ship) Telegraph Co. May 15th.

7,366. ELECTRICAL TRANSMISSION FOR AUTOMOBILE VEHICLES. Daimler Co., F. W. Lanchester & J. L. Milligan. May 17th.

7,367. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). May 17th.

10,762. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & A. A. Pollock. July 24th.

11,627. FLUID-PRESSURE STARTING AND STOPPING DEVICES FOR ELECTRIC MOTORS OPERATING PUMPS. Westinghouse Brake Co. August 11th. (December 24th 1914.)

13,207. ALLOYS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 15th

17,535. TIME-LAG ELECTRIC SWITCHES. Allmanna Svenska Elektriska Aktiebolaget. December 15th. (January 9th, 1915.)

17,876. KEYBOARD-CONTROLLING DEVICES, PARTICULARLY APPLICABLE TO TELEPHONE SYSTEMS. Western Electric Co. (Western Electric Co., U.S.A.). December 22nd.

1916.

339. RADIOTELEGRAPHY APPARATUS. W. J. Mellersh-Jackson (A. Arbib). January 7th, 1916. Patent No. 100,384.